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The Future of Electric Traction.

TO THE EDITOR OF ELECTRICAL REVIEW:

The subject of the adaptation of the electric motor to street car and other traction is one that has been fully covered by the leading exponents of the various systems, and little has been left to say regarding the present state of the art.

To the observing mind, however, it will appear that we have by no means reached the limit of success or perfection which we ought to attain, and on the contrary it would seem that, while the relative economy and advantage of electric traction have been clearly proven, we are as yet far from that coveted perfection, in mechanical details, at least, that has been attained in the modern steam locomotive. Some of the greatest minds of the age have bent every effort to bring about the present semi-satisfactory state of electric traction, and the same minds are eagerly looking through experiments and practice to find a solution of the problems that present themselves before us every day.

There are now about 300 street car lines, with the approximate number 4,000 cars, in operation or in the course of equipment to-day, representing about 25 millions of dollars, invested by shrewd business men in this one line, and that, too, almost entirely within the last three years. I think, too, that I am safe in saying that every street car line in this country that has been equipped and operated commercially has been successful and a dividend-paying investment. Furthermore, we know of many instances where old horse car lines that were running behind each month have been bought up, reconstructed, and equipped with some good electric system, and have proven to be a handsome paying investment, owing to the increased traffic and the decreased operating expenses per car mile.

In view of these undeniable facts, it may seem that we have reached a stage where further effort is uncalled for in the line of perfecting the electric street car. Such, however, is most certainly not the case, and I firmly believe that the immediate future has great advancements in store for us in the mechanical as well as the electrical details of the electric street car. Among the managers of street car lines operated by any reliable electric system to-day, we find the almost undivided opinion that a relatively higher degree of perfection has been attained in the electrical than in the mechanical details. And there can be no doubt that to-day any street car line, and perhaps even our larger steam railroads could be operated with a higher degree of economy by the electric motor than by any other system, provided the mechanical construction of the motor and its application was worked out more carefully and more in accordance with the best mechanical knowledge of the present day. The distribution of power by electricity to numerous isolated motors on a large scale has proven successful in many of our large cities and shows a high economy over operating many small engines. The same general plan should show high efficiency in distributing power by electricity from large central stations to moving motors on the present steam or street cars if the mechanical construction and application of the motor to the car or train was perfected. Among the first roads operated in this country some effort was made to depart from the ordinary style of horse car, either by making a separate electric motor car to draw a train or by placing the motor in the front of the car, above the floor, leaving only a portion of the car for seating passengers.

While this proved in a measure successful, yet at that time there were some decided objections to it: First, the mechanical arrangement as related to the transmission of the power from armature to car was faulty and crude. Secondly, street car companies were slow to discard their old rolling stock and purchase the new form of cars. The demand was evidently for some style of motor that could be readily adapted to the ordinary form of horse car, either closed or open, with the least possible expense or waste of material. The demand was filled by the present form of motors, and old horse cars were equipped and, without even a coat of paint, were sent out as full-fledged "electric cars." The car axle was chosen as the only suitable spot for the motor to be placed, and the universal adoption of this method might go to show the wisdom of this choice, although the wear and the rapid depreciation of the working parts subject to severe strain and continuous service running through sand and dust and water offers a powerful argument for the location of the motor in a higher and dryer place, if possible.

It is in connection with some of these points that I feel that a change may be expected and dare to prophesy a decided advancement and improvement in numerous details. There can be no question that in a great measure the present method was the outcome of necessity rather than choice, and that any manufacturer of an electric railway system would gladly acknowledge that the motor would work better and last much longer above than below the car floor. Why, then, are they invariably placed there? The answer is simply that, the street car companies want them there and the laws of demand fix the nature of the product. Would not a little thought and calculation prove that it would be economy to use a longer car and have one end only devoted to the motor. What will be the result? We shall have perhaps longer cars. The cars will have at least six wheels. The forward truck being movable, any desired curve can be rounded with ease; the weight will be fairly distributed on the rails, the car will ride easily and smoothly. The motor will be up in a dry warm room and the motor man *can* and *will have* the motor under his eye at all times, to see that everything is right and detect and remedy any weakness that may show itself. This means that a motor will last years and that the depreciation will be slight and the expense of operation will be reduced to a minimum. The same car can haul others or smaller dummies may be used to haul any desired number. Motors of slow speed will be used, noiseless gears with teeth of soft material will replace the clattering cogs and iron gears of to-day. Some device will be found other than a friction clutch to allow the armature to run free when the car is at rest, and to enable the motorneer to start his heavy load up grade without danger of burning out an armature. The next step, perhaps, will be to eliminate entirely the gearing and place the armature directly about the car axle; when this is accomplished, the steam locomotive must give way to advanced ideas and we shall run through our streets and over the country at any desired speed without smoke, cinders or fire, and travel will then be indeed a luxury. All this will be accomplished before another decade has passed. A. H. CHADBOURNE.

Phila., Nov. 12th, 1890.

Description of the Electrograph.

RECENTLY PURCHASED FOR THE METEOROLOGICAL OBSERVATORY OF THE MASSACHUSETTS AGRICULTURAL COLLEGE, AT AMHERST, MASS.

[Written for the ELECTRICAL REVIEW by C. D. Warner, Professor of Physics, Amherst.]

The electrograph recently received at this observatory consists of a Thomson's quadrant electrometer, registering apparatus, and water-dripping apparatus. A partial description of the different parts will be found under their appropriate headings. When in proper position, the electrometer is inclosed in a glass case, the registering apparatus in a mahogany case, and the whole arrangement is mounted on a strong slate slab. The instrument was obtained through Richard Kuy & Co., of New York, and was constructed by Elliott Bros., of London, from special drawings made by Sir William Thomson. It was made especially for this observatory and was designed for observations in atmospheric electricity.

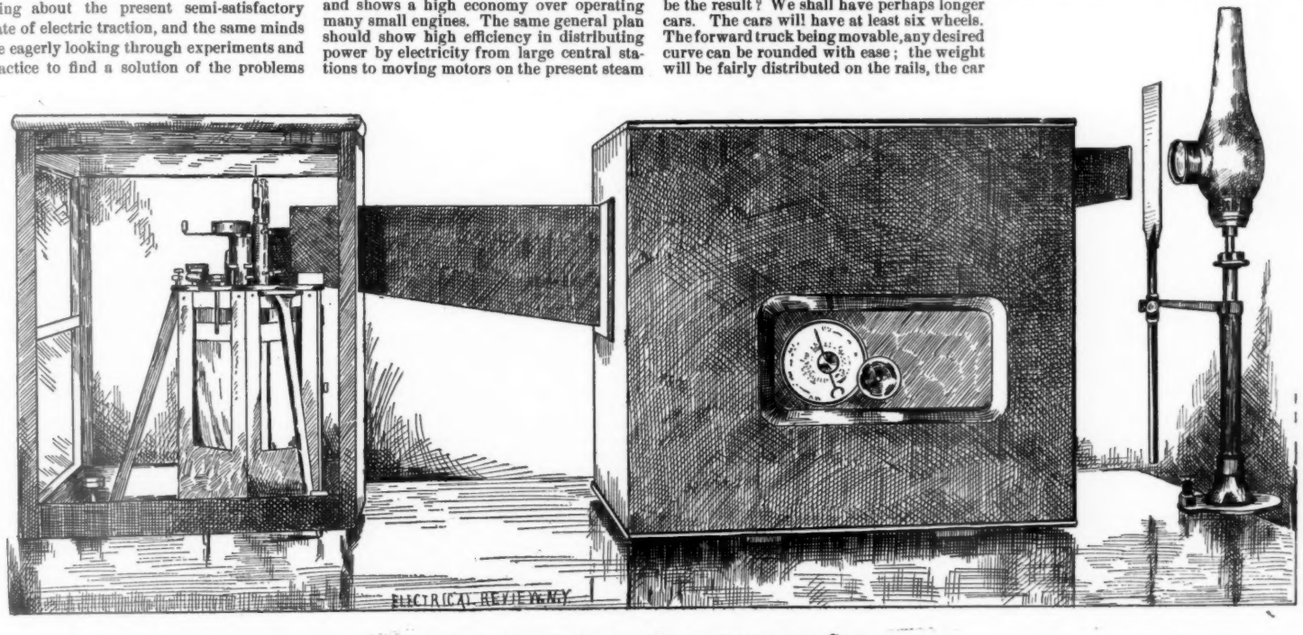

FIG. 1.—AMHERST COLLEGE ELECTROGRAPH, WITH CASE.

THE ELECTROMETER.

The quadrant electrometer, see Fig. 4, has first a white flint glass bell jar, surrounded and supported mouth up by a metal casing. The outside of the jar is partially covered with tin-foil, while the inside contains strong sulphuric acid to the depth of about three inches. The acid serves a three-fold purpose: (*a*) It keeps the air inside quite dry, thereby insulating parts required to be so; (*b*) it holds a charge of electricity, hence acts as an inner coating of the jar; (*c*) it allows the needle to become charged without impeding its movements. Over the mouth of the jar is the main cover, a circular brass plate, screwed down to the metal casing, and is secured so as to be air-tight and prevent the entrance of moisture. Over a large circular hole in the cover stands the "lantern;" the latter is of brass and covers the mirror and its suspending arrangements. It has a glass window in front and allows the ray of light

to fall upon the mirror and be reflected back on the scale. It also carries the "gauge" and three electrodes; the latter project from the top. Four quadrants supported by short glass pillars project downward from the main cover. The quadrants are movable in radial slots, and can be drawn out or pushed in toward the axis of suspension. When the instrument is in adjustment, the quadrants are arranged symmetrically about the needle. One of the four is capable of adjustment by turning a milled head screw; the moving of this quadrant also serves in adjusting the zero of the instrument. Each pair of opposite quadrants is connected by a fine wire, and from one quadrant of each pair rises an electrode, which, insulated, passes through the top of the lantern. These electrodes serve to connect the two conductors whose difference of potentials is to be measured. The third electrode, seen projecting through the top of the lantern, is for charging and discharging the Leyden jar of the electrometer.

THE NEEDLE.

The needle consists of a flat piece of sheet aluminium shaped like a double canoe paddle, and is fixed horizontally to a stiff vertical platinum wire which passes through its center upward and downward. A small cross-bar is attached to the upper end of this wire, and the whole is carried by a bifilar suspension of cocoon fibres. To the lower end of the stiff platinum wire is attached a very fine platinum wire, carrying a small plummet, which dips into the sulphuric acid at the bottom of the jar. By this means, the needle is brought in contact with the inside coating of the jar and is charged. The platinum wire carrying the needle has also a small circular mirror attached to it. This mirror is a concave mirror of silvered glass; it is about 15 millimetres in diameter and weighs about one-third of a grain. To make these little glass concave mirrors is indeed a delicate task. A large number of the little circles of the finest microscope glass is silvered. The mirrors are then tested separately to see if each one will give a good image of a lamp reflected from it. Only a very few out of perhaps a hundred are found to be perfect. The concavity of the mirror is such that reflected rays of light are brought to a focus about one metre distant from the mirror. All the movable parts are carefully guarded from external influences; the platinum wire, both above and below the needle, is protected by a metal "guard tube" through which it passes, and the mirror by a little cylindrical hood projecting some distance from the suspension plate.

The whole principle of the instrument depends upon the potential of the needle remaining constant throughout the time a series of observations are being made. The sensibility of the instrument is really proportional to the potential of the needle, therefore, by altering the charge of the Leyden jar, we can alter at will the sensibility of the electrometer. As this constant and normal condition is very essential in making a series of measurements, it is of great importance that some means be devised whereby we can know at any time the electrical condition of the needle. The latter is accomplished by

THE GAUGE

connected with the instrument. The gauge is really a very delicate electrometer. It consists of two metallic disks having their planes parallel and close to each other. The upper disk G has a square hole immediately over the center of the lower disk. The latter is in electrical connection with the acid of the jar. A piece of white sheet aluminium, shaped like a spade, is carried on a tightly stretched platinum wire *f*, as seen in Fig. 3. The blade *p* covers the square hole in the upper disk. The rung of the handle *h* is a very fine black hair, and behind the hair stands a porcelain pillar with two black dots upon it. The arrangement is looked at through a plano-convex lens *l* a little distance off. When the lower disk is charged the blade is attracted and the rung of the handle is raised. If the handle sinks below the mark, we know the potential of the jar is falling. The instrument is in proper condition when the hair is midway between the dots. The gauge is controlled by a very delicate electrical machine called the "replenisher," turned by the finger.

REPLENISHER.

The replenisher consists of two curved shields, one of which is in connection with the acid in the jar, and the other with the framework of the instrument and through it the tin-foil outside of the jar. Two metal wings, curving outward and insulated from each other by a small bar of ebonite, are made to revolve within the shields. During such revolution of the wings, the latter are made to come in contact with two springs connected together, but insulated from the rest of the instrument. The wings come in contact with the two springs at the same time, and being thus connected and under the influence of the shields, the positive electricity of the left hand shield, say, draws negative electricity to the left hand wing, close to it, and drives the positive to the right hand wing.

Continuing the revolution still further, the wings clear the springs; but, though disconnected, each wing retains its charge. Further rotation brings the right hand wing with the positive charge in contact with the left hand shield, and the charge is sent to the jar. The negative electricity on the left hand wing runs to the outer coating of the jar.

The shields are now neutral, as at first, but by continuing the rotation, the process is repeated. Every turn increases the potential of the jar, and we can augment it as much as we choose. By reversing the motion we can likewise diminish the charge. The instrument is so extremely sensitive to slight variations of potential, that a few turns of the replenisher will supply any loss, however small.

WATER-DRIPPING APPARATUS.

The water-dripping apparatus is a strong cylindrical tank of galvanized iron, two feet in diameter and 18 inches in depth. The tank stands on three solid glass supports set in feet made of mahogany wood, the glass supports are incased in cylinders of thick glass in which may be placed pumice stone soaked in sulphuric acid in order to better the insulation. From the tank a pipe projects about five feet and terminates in a fine orifice, the water flowing through the latter breaks into drops immediately after leaving the nozzle of the tube. An insulated wire connects the vessel with the electrometer placed in-doors. A short time from the starting of the stream the can will be found to be electrified to the same potential as the air at the point of the tube, this potential is imparted through the conducters to the electrometer and a deflection of the needle ensues.

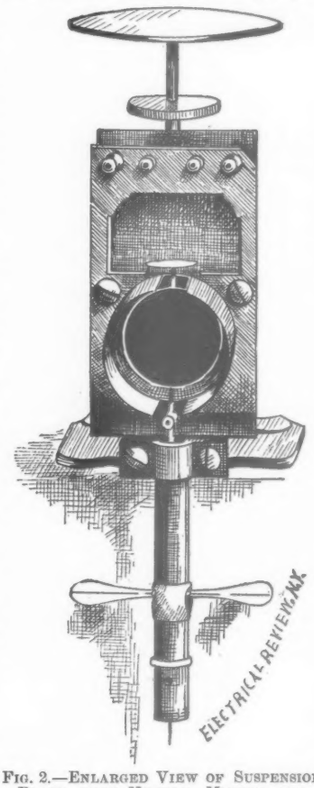

FIG. 2.—ENLARGED VIEW OF SUSPENSION PLATE, WITH NEEDLE, MIRROR AND LOWER DISK OF THE GAUGE.

REGISTERING APPARATUS.

The registering apparatus consists of a powerful clock with weight, second pendulum, dial and gearing. The latter connects with, and turns a cylinder provided with a pair of thin brass bars furnished with spring hooks and hinges for holding the sensitized photographic paper. The cylinder turns once in about 30 hours. The sensitized paper, or chart, is provided with a zero line and suitable scale divisions. On one side of the zero line the positive potential is recorded, and on the other side the negative. In front of the cylinder is a long cylindrical glass lens. Near one side of the case covering the cylinder is a gas burner with an opaque chimney carrying a round glass window on one side. The pencil of light passes through the window and also a vertical slit in the case, falls upon the mirror connected with the needle, and is reflected back upon the cylindrical lens which concentrates the rays in a point. This follows the motion of the mirror and thus impresses upon the sensitized paper the curves which measure the electrical potential of the air. A shutter suitably geared from the clock intercepts for four minutes, every alternate hour, the passage of the light, the gaps marking a time scale on the paper. During the same time the quadrants are put to earth and thus discharged. The mirror then reverts to the zero line and commences a new trace.

This electrograph is like the one at Greenwich observatory. It is the latest and most improved of Sir William Thomson's instruments, and is most valuable and useful for accurately measuring potentials, and extremely so for the observation of atmospheric electricity. No instrument is more ingeniously contrived, delicately arranged and capable of producing continuous photographic records than this one. Few of these electrographs are in operation. Some of the observatories of Europe are supplied with an old form of the instrument. In the observatories of Montsouris and Kew, especially the latter, the instrument has no gauge and no replenisher, and each pair of quadrants is connected with 30 or more cells, and the needle receives its charge direct from the atmosphere. But with the latest improved instrument, no such battery is required. Its potential is controlled by delicate arrangements, and the needle is charged through the acid in the jar. While parts of this instrument may be found in the different laboratories of our institutions, it is thought that the electrograph at Amherst is the only complete one of its kind in this country.

A New Supply Combination.

Alexander, Barney & Chapin and the Fibrone Manufacturing Company, both of this city, have entered into an agreement by which the first named firm secures the exclusive control for the United States and Canada of all the electrical products of the latter company. Hereafter, the Fibrone Company will add the manufacture of alexite to its business, according to this new agreement. Alexander, Barney & Chapin have had difficulty in securing the proper facilities for manufacturing alexite, which requires powerful machinery of special construction. By the new deal this difficulty will be overcome. The Fibrone Company is the only concern in New York having the facilities adapted to this purpose.

By this new combination several new insulating materials will be put upon the market, and their manufacture actively prosecuted. The materials in question differ in composition according to the use for which they are designed.

Plasticon, which will be used for switch handles, push buttons, etc., is waterproof and capable of withstanding a high degree of heat. It will be made in a number of colors, some of the combinations being imitations of wall paper, marble and natural woods. Such brass parts as are necessary in connection with the various fittings to be made of plasticon, can be imbedded therein, combining convenience and some saving in cost.

Alexite is claimed to be absolutely fire, water and acid proof. It can be colored and molded in any shape, the brass parts being imbedded, if desired. Cut outs and switch bases, cleats, rosettes, etc. made of this material, should possess many advantages, one being its appearance, and another the fact that it is not brittle, and therefore will not crack under screws.

Fibrone is somewhat similar in appearance to plasticon, but will stand a much higher degree of heat. It can be tapped and drilled, worked on a lathe, and given a "piano" finish, that is, a high polish. The colors will be similar to those of plasticon. As it can be made in sheets of any thickness, fibrone will probably be extensively used for the insulating pieces of sockets.

Another form of material, herculite, is said to have immense tensile strength, besides being fire, water and acid proof. Its uses will be of a special character, and as it is of light weight, and can be turned out in sheets ten feet square, its adaptability for switchboards is apparent. This material can also be drilled and tapped and made in colors. Owing to the facility with which it can be handled, hercuiite will be in demand where a mold is not required or can be dispensed with, in case many duplications of one article are not desired.

The processes employed in coloring all these materials are peculiar, but elastic in their applications. Almost any color or combination of colors can be faithfully imitated. The advantage of this fact will be appreciated in the manufacture of house fittings, which can be made to harmonize with the decorations of the room in which they are used.

To supply the demand that is likely to arise for these new materials, the factory of the Fibrone Manufacturing Co., at 300–302 Monroe steeet, this city, has been enlarged and sixteen new hydraulic presses added to those already in place. A full line of goods will soon be on exhibition at the warerooms of Alexander, Barney & Chapin, in the Telephone building, 20 Cortlandt street, this city, and the firm is making every preparation to fill all orders.

The Properties of Alternating Currents.

At a meeting of the Boston Electric Club, held last week, Prof. Elihu Thomson spoke as follows on the subject of "The Properties of Alternating Currents," illustrating his address with many interesting experiments:

Prof. Thomson said that we were all acquainted with the fact that only in recent years had the alternating current come to be an important factor in the electrical industry. Previously the continuous current, or as it was more familiarly termed, the direct current, was chiefly used for doing useful work. In some respects the continuous current was simpler than the alternating current, yet it was the very lack of simplicity in the latter which enabled the scientist to accomplish the results with it which could not be achieved with the continuous current. The difference between the two was that the continuous current flowed in one direction only, while the alternating current changed its direction more or less rapidly. The alternating current could be utilized when its alternations were as low as 100 to 150 per second. The alternations effected in a current used for lighting were from 200 to 250 per second.

The alternating current had been experimented with when the alternations were as high as 8,000 per second. It might seem difficult to conceive such a thing as changes at the rate of 8,000 per second, and yet it is possible for machines to be made which will quadruple even that number. What is needed is a machine that will enable us to have an alternating current making 500 trillions of vibrations per second, which would produce many wonderful results. The various properties connected with the alternating current were properties not so much of the current itself as of the magnetic field. If one took an incandescent lamp and examined it when in service, the phenomena would be the same whether it be on a continuous or alternating current circuit. Yet the mechanical differences in such an instance were very striking.

Professor Thomson described the characteristic features in the generation of the two kinds of current, and the action of the magnetism in the fields of the dynamos. He then showed how converters are constructed and operate in the production of induced currents on a secondary circuit, the converter modifying the current in the primary as it passes on its way to the secondary. In confirmation and illustration of his lucid description of the difference between the two currents, the manner of their generation and operation, the speaker showed some elaborate experiments. He had a powerful coil placed on end on the lid of the box before alluded to, and secured to and in front of an upright wooden support to which he was enabled to attach first one device and then another. His assistant having turned on an alternating current, the professor held a copper ring about six inches in diameter and three-eighths thick, in the air above the top of the vertically placed coil, and by induction the ring was supported in mid air. Then, placing a second ring below the first it clung to it by magnetic force. According to the positions or the angles at which these rings were presented to the coil so were the tendencies in the rings to kick or jump or float in the atmosphere. Then a hollow copper ball was placed on the coil and immediately began to rotate at a fearful rate, having to be surrounded by a barrier, as it were, to prevent it jumping right off the coil. Being placed on a shallow dish or plate and held just over the coil, the ball still gyrated, its movements being speedily stopped when a plate of copper was interposed between the pole of the coil and the under side the plate on which the ball lay, thus demonstrating that the current was shaded off by the copper plate.

A copper disk, made to revolve on its center between a forked handle, started off at a great rate of speed when held near the coil, the direction of its running being alternated according to the manner and position in which is was held near the coil. Iron and steel disks were also tested in a similar manner. The manner in which a cast-steel file is affected by an alternating current was also shown. To prove the principle on which incandescent lamps are operated by an induced current, a glass jar of water was placed over the coil. In the jar, submerged in the water, was a coil to which was attached an incandescent lamp.

By simply raising or lowering the jar from or towards the coil, the incandescent was brilliantly illuminated, the slightest movement in the position of the jar being instantly detected in the increased or diminished brilliancy of the lamp. As Professor Thomson remarked, such a phenomenon as that of having a lamp lighted without any actual contact with anything about the coil, proved that the current itself overcame the intervening substances of the glass and the water, and accomplished the result of charging the small coil in the bottle, to which the lamp was attached. As the lamp increased or diminished in brilliancy, the speaker facetiously said that experiments proved there

was no longer any truth in the assertion that the electric light could not be raised or lowered.

With a deep inverted glass vessel fixed rigidly above the coil some most startling things were done. Some water was poured into the vessel and a large hollow copper ball dropped into it. The ball instantly began to rotate in the water at a great rate.

Then a smaller ball was dropped into the water which was soon in a state of violent ebullition by the opposing circuits of the revolving balls. A shallow copper bowl was added to the commotion in the water and it likewise took up a rapid gyratory motion, the circus in the water provoking loud laughter. There was not the slightest connection of a mechanical nature between the coil through which the current was passing and the vessel in which was the water and the many gymnasts, Prof. Thomson explaining the phenomena by stating that it was accomplished by the vibratory motion in the mineral ether; in other words, it was an induced current.

Some beautiful experiments in electric welding by an induced current were also shown. An open circuit coil being suspended over the energized coil, the two ends of the suspended coil projecting outward, the result being that no effect was produced in the coil. When the circuit was complete d by the ends of a piece of wire being laid across the terminals of the coil, immediately that coil was energized and the wire heated to white heat and welded.

One of the most pleasing experiments was that of a device somewhat like the gyroscopic top. The various parts of this device were set in motion in opposite directions according to the angle at which it was held in relation to the coil, and at last when a counter weight had been adjusted to the spindle on the end of which the gyroscope was revolving, and the whole delicately poised on a rigid point fixed in the core of the energized coil in a horizontal position, various parts of the entire device described at a great rate, and simultaneously, several different circles, all of which could be reversed by slightly altering the relative position of the counter weight. The graceful movements of this little wonder created loud applause. Prof. Thomson remarked that such a top as he was then playing with never required winding up like the ordinary one.

The final illustration was with a small alternating motor. It consisted of a circular coil fixed horizontally with a slot cut through one side. A vertically poised disk being placed near or in the slot commenced to rotate rapidly when current was turned on. The disk being removed, Prof. Thomson showed how the little alternating circuit motor could be utilized as a counterfeit coin detector, for it possessed this remarkable characteristic, that if a genuine silver coin was placed near the slot, it would be drawn into the vortex as it were and instantly flung out on top of coil, whereas a counterfeit coin would not be in the slighest degree affected.

Nickel-in-the-slot machines might be made on such a principle that there could be no tampering with them; they would reject spurious coins and refuse to operate unless a genuine coin was placed in the slot. This fact was demonstrated again and again by by Prof. Thomson, amid laughter and applause.

A rising vote of thanks was then tendered Prof. Thomson for his instructive address.

A patent has been taken out in France for an electric furnace for the rapid incineration of human remains.

National Academy of Sciences.

The National Academy of Sciences held the first meeting of its annual Autumn session in Boston, last week.

Prof. O. C. Marsh, of Yale University, the president of the academy, called the meeting to order. Among those present were: Prof. Langmaid, of the Smithsonian Institution, Washington; Gen. F. A. Walker, president Massachusetts Institute of Technology; Prof. S. C. Chandler, Cambridge; Prof. E. C. Pickering of the Harvard Observatory; Prof. A. Hall, secretary of the United States Naval Academy; Prof. E. S. Morse, Salem; J. Walker Fewkes, secretary Boston Natural History Society; Major Powell, of Washington, the eminent geologist; Prof. A. E. Dolbear, of Tufts College.

In the morning session, papers were presented: "On the primary cleavage products formed in the digestion of the albuminoid

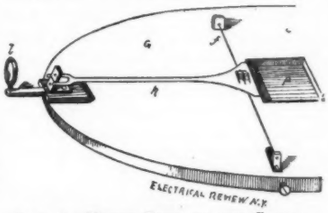

FIG. 3.—UPPER DISK OF THE GAUGE. G, DISK; f, TERSE WIRE; p, BLADE; h, HANDLE; l, LENSE.

gelatin," by Prof. H. R. Chittenden, a newly elected member from Yale University; "On the classification and distribution of stellar spectra," by Prof. E. C. Pickering, of Harvard; "On electrical oscillations in air, together with spectroscopic study of the motions of molecules in electrical discharges," by Prof. John Trowbridge, of Harvard; "Some considerations regarding Helmholz's theory of dissonance," by Prof. Chas. R. Cross.

At the afternoon session two papers were read, one by Prof. Bowditch, "On the percentile growth," and one by Gen. F. A. Walker, "On a probable error in enumerating the colored population in the census of 1870."

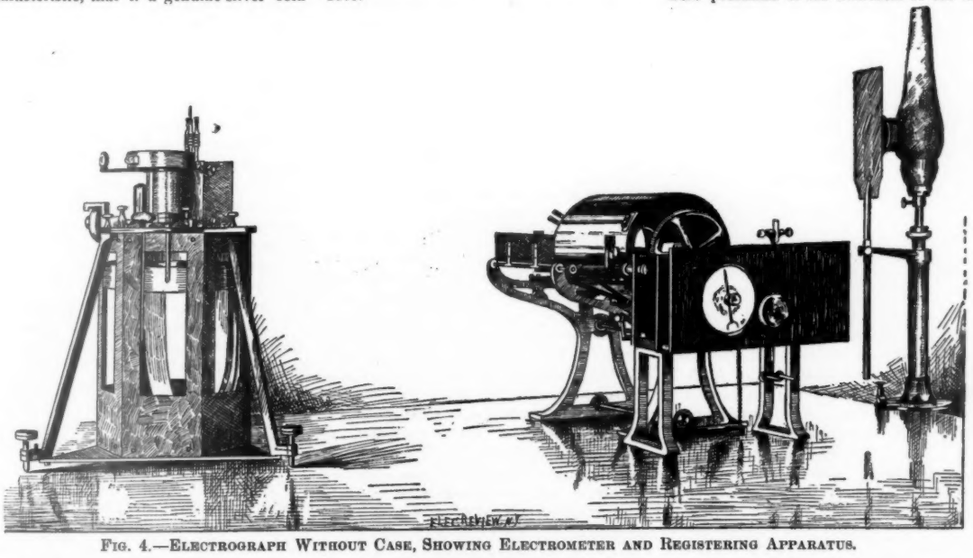

FIG. 4.—ELECTROGRAPH WITHOUT CASE, SHOWING ELECTROMETER AND REGISTERING APPARATUS.

Foreign Electrical Work.

By a resolution of the Chamber, Vienna is to receive an enormous increase in its size through the inclusion of all its suburbs. The enlarged town is to have its means of communication improved, and an underground electrical railway has been projected with that purpose. Electric traction may possibly be introduced on the tramways which encircle the town. At the last sitting of the Common Council, Herr Kareis obtained a credit of 28,000 florins for the enlargement of the southern part of the electric lighting station in the town hall; the number of lamp hours will be increased to 700,000, and the price of a lamp hour will be 2.7 kreuzers, instead of 6.3 kreuzers as at first. The total cost of the electric lighting of the Vienna Town Hall will thus amount to 229,000 florins. Messrs. B. Egger & Company will carry out this enlargement.

Within the last few weeks two new central stations for the electric light have been started in Madrid. There is already a demand for 16,000 lights, of which the two companies have an equal share. If the light should prove satisfactory, this demand will be largely increased, as great complaints are made against the prices charged by the gas company. The electric light can be supplied here at half the cost of gas, which is now charge for at the rate of 9*s.* per 1,000 cubic feet.

Messrs. James Lewis & Sons, London, in their monthly report, state that the price of good merchantable copper for immediate delivery advanced from £59 7*s.* 6*d.* per ton on the 1st inst. to £60 7*s.* 6*d.* on the 6th, but quickly fell away, until it reached £57 7*s.* 6*d.* on the 15th, this decline of £3 being due to the uneasy feeling prevailing on the Stock Exchange, the fear of dearer money and free selling by the representatives of one of the largest holders. The market closed on the 16th at £58 13*s.* 9*d.* for cash, and £59 2*s.* 6*d.* for three months' prompt.

There are not many electric light installations in Spain, says *Industries*, but an important central station has been erected in the Calla de las Mozas, Seville. Steam is supplied by six Belleville water tube boilers, which are fed by four donkey engines, the arrangement being such that all or half of them are capable of maintaining the supply. Four vertical compound Offman engines are used, running at 350 revolutions, the pressure being 23 pounds. The Oerlikon Maschinen Fabrik have supplied the dynamos, which are of the Brown type, and have a capacity of 480 amperes and 110 volts. The mains are all placed underground, and branches are taken off at suitable intervals. The cables consist of copper wires, insulated by several layers of pure vulcanized india-rubber, the whole then being placed in a leaden pipe. The glow lamps vary from 10 candle-power to 100 candle-power, and the arc lamps from 500 candle-power to 1,000 candle-power.

According to *La Lumière Electrique*, the French Government recently proposed to divide the quarter of a million sterling arising from the Henri Giffard bequest among the several government departments, for the purpose of assisting various urgent departmental schemes; and the necessary decrees were presented to the President of the Republic for his signature. Energetic protests were, however, made against this mode of appropriating this fund, and the intention of the authorities now is to found an institution for the purpose of stimulating and assisting the spirit of invention and research, to help men having "happy ideas" to put them into practice, and to endow France with an institution which shall be free from scientific and administrative routine without becoming a refuge of Utopians. Our contemporary remarks: "This problem is not an easy one, and we may anticipate that there will be numerous experiments before a thoroughly satisfactory solution is arrived at."

In a few days from now the authorities of Brussels will open a competition for a model of the Venetian masts intended to support the electric lighting apparatus in the Grand Place.

Temple, Tex. — Temple Electric Light Company; capital, $30,000.

Chicago, Ill.—Chicago Electric Kaleidoscope Company; capital, $250,000.

Philadelphia, Pa.—The Manufacturers' Electric Company; capital, $50,000.

Butte City, Mont.—Electric Mining and Reduction Company; capital, $450,000.

Astoria, Wash.—Astoria Electric Power and Transit Company; capital, $150,000.

Appleton, Wis. — Standard Lamp Company; to make incandescent lamps; capital, $25,000.

Huntington, Ind.—The Huntington Electric Light, Gas and Fuel Company; capital, $50,000.

Chicago, Ill. — Northwestern Electric Motor Company; capital, $1,000,000. Incorporators, T. B. Bryan, Frank Weeks and M. W. Towle.

Chicago, Ill.—American Conduit and Traction Company; capital, $1,000,000. Incorporators, H. B. Hallock, A. M. Day and C. P. Chapman.

Cleveland, O.—Woodland Electric Company; capital, $30,000. Incorporators, Alfred Arthur, Howard F. Loomis, Isaac F. Richman, Kate S. Arthur and Ada A. Burnham.

Beaver Falls, Pa.—Central Electric Street Railway Company; capital, $60,000. Directors: John C. Whitlea, Albert M. Jolly, Almond R. Leyda, John A. Elliott, Beaver Falls; Stephen P. Stine, Bridgewater.

Saratoga, N. Y.—The Union Electric Railway Company; capital, $300,000. Directors: Henry Russell, Charles E. Arnold, Edward J. Slattery, Clifford D. Gregory, Henry L. Smith, Meyer Nussbaum and A. J. Voyer, of Albany; W. J. Arkell, Canajoharie; and L. H. Cramer, George I. Humphrey, William Hay Brocker, J. W. Lester and C. S. Grant, of Saratoga.

Business Change of a Philadelphia Company.

Mr. W. A. Stadelman, who has for some time been connected with the firm of Chadbourne, Hazelton & Company, of Philadelphia, has recently severed his active interest in that concern, and has reorganized the Equitable Electric Railway Construction Company, of which he was chief engineer, and will devote his entire energies to the new concern.

The new company will be known as the Equitable Engineering and Construction Company, and a new charter has been applied for which will give the company the right to not only equip electric railways, but to buy and sell or lease or operate them. The old company will go out of business by liquidation, and the new company will take its place.

Handsome new offices in the Drexel Building have been taken, and the new company have already several large contracts, one for an electric railway in the South, and one for a complete central station alternating current lighting plant, including engines, boilers, buildings, etc., to be erected near Philadelphia.

The capital of the new company is $50,000, and the officers are as follows: J. A. McKee, of the Tradesmen's National Bank, president; H. J. M. Cardeza, of Cardeza, Gilliams & Company, secretary and treasurer; W. A. Stadelman, manager and chief engineer. Directors: J. A. McKee, J. L. Stadelman, L. Gilliams, F. D. LaLanne, W. A. Stadelman.

Societe des Metaux.

A recent issue of the Paris *Matin* says the report of the liquidators of the Société des Métaux shows that, despite the rise in the price of copper, the shareholders of the company will receive nothing. The debenture holders and other creditors will receive only 34 per cent. The final liabilities of the company is estimated at 111,000,000 francs, and the assets at 38,000,000 francs.

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There are now five condemned murderers in solitary confinement in the prisons of this State awaiting the decision of the courts as to whether they shall be roasted to death by electricity, as was Kemmler, or hanged by the neck until dead. The restraining processes of the law seem nearly exhausted, and we may yet be compelled to record other harrowing scenes at the death of these men.

It is safe to say that this office is in receipt of a letter a day, on an average, from subscribers asking for the date of the appearance of a certain article or illustration in which they are interested. These letters receive the consideration they merit, and, while we are always anxious to serve our subscribers in any way within our power, we would respectfully remind them that an index is sent out with the issue completing each volume of the ELECTRICAL REVIEW. This index is very carefully prepared, every article being mentioned under all of its principal titles. A few minutes consultation of the index by any one in search of information which can be found there, will save a sheet of paper, an envelope, a two-cent stamp and a few minutes time, at each end of the line.

One of the theories advanced as to the cause of the foundering of the British warship "Serpent" off the Spanish coast, is that the disaster was due to compass deviation, caused by the presence of a great mass of magnetic ore in the mountains on the coast.

There are over 5,000 buildings in Philadelphia equipped with electric wires for light and power purposes. During the present year, the insurance companies writing these risks have not suffered a dollar's loss from fires caused by electric wires. Fires from this cause in previous years have been so few and far between as to create great surprise when they did occur. A perfect understanding is said to exist between the insurance and the electrical companies. The natural result of this is good installations, which fact explains why fires from electrical causes are so few in Philadelphia.

The electrograph just received at Amherst College, a fully illustrated description of which is contained in this issue of the ELECTRICAL REVIEW, is an instrument of great value in exact electrical measurement. Instruments of this type are, of course, useful only in the hands of a pure scientist, but an increase of delicacy in their power may yield results of great practical importance by leading to a closer insight into the relations between electricity and atmospheric phenomena and enabling results, which at present are looked upon as of separate origin, to be traced to a common cause. Meteorology is a science as yet in its infancy, as evidenced by the many errors in signal service predictions, but the day is not far distant when the story told by such instruments as the electrograph will be understood as a precursor of atmospheric conditions which must surely follow. Every improvement made upon these instruments, therefore, is fraught with consequences as great in importance as those due to the great industrial inventions which characterize this epoch in the world's history.

THE PHONOGRAPH IN THE SICK ROOM.

Dr. J. Mount Bleyer, of New York, one of our specialists for the diseases of the nose and throat, has been carrying on experiments for several years with the phonograph in recording the normal and abnormal voices of singers, and preserving the record for future use as a reference. Also for teaching the students of medicine the different characteristics of coughs, etc., in different diseases, as whooping cough, stenosis of the larynx, nasal tones, coughs of bronchitis, asthma, etc.

This method of teaching it is thought will revolutionize all other methods in vogue. Dr. Bleyer has succeeded in storing up a large amount of records for demonstrating his paper upon that subject before the medical societies of New York.

STABILITY OF CHARGE IN STORAGE BATTERIES.

M. Gaston Roux states in *L'Electricien* that storage batteries may be allowed to remain standing in open circuit for long periods of time without material loss of the stored energy. Two cells of the Julien type, each having a capacity of 200 ampere hours, were tested. The cells are of glass, and are contained in wooden boxes filled with sawdust and supported on oil insulators. The solution contains about six per cent. in volume of saturated sulphate of soda. The two cells were charged to saturation on August 5, discharged on August 6, and recharged on August 7. On October 20, two months and 13 days later, they were discharged. The discharge was stopped on both August 6 and October 20 when the E. M. F. had fallen to 1.8 volts per cell. The quantity of electricity was found to be 233 ampere hours on August 6, and 220 ampere hours on October 20. Assuming that in each charge the accumulators stored the same quantity of electricity, we may conclude that the accumulators lost on open circuit only 13 ampere hours, or six per cent. of their charge during two and a half months. "This result seems to me," continues M. Roux, "to prove that accumulators well-made, well-charged, and well-insulated, are not injured by being left on open circuit. It also shows the good quality of these particular cells, and proves again that there is no local action between the active material and the antimony alloy supports. I should have liked to have carried out a similar test on accumulators with plain lead grids, but I had none at my disposal."

PATENT CENTENNIAL.

It has been proposed to commemorate the close of the first century of the American patent system by a convention of inventors at Washington, in April, 1891, when the centennial celebration of the establishment of the national capital at Washington will be held. Several meetings have been held by residents of Washington, and a committee will be appointed to give some definite shape to the project. If enthusiasm can be awakened among representative inventors, such a convention might lead to much good. The only reason that the patent laws have not kept pace with industrial progress, and are, therefore, so sadly in need of revision, is that inventors lack organization and cannot make members of Congress feel that their rights must be recognized. Our great national prosperity is more largely due to the ingenuity and fertility of resource of the American inventor than to any other cause, and the patent system should be liberally handled as an act of gratitude, if for no other reason. But it is not. If the inventors will join hands matters can be expedited. The idea of having an industrial exhibition as part of the celebration would probably be difficult to realize. Such inventors as have succeeded commercially would have no desire to take a hand in this, and the companies handling their inventions, not finding any profits in sight, would not show any enthusiasm.

By all means get the inventors together if possible, and let them swap ideas. It is always profitable for bright minds to rub together; it rasps off the rugosities with which genius usually bristles. The inventors of the telephone and phonograph and the perpetual motion crank will be in striking contrast, but they have a common interest in the improvement of our patent system.

BOOK NOTICES.

"Electric Railway Advertiser," is the title of a new aspirant for favor in the electric railway field. Dr. G. L. Austin, of Boston, the proprietor of "Practical Electricity," is the progenitor of the new venture.

"Reports from the Consuls of the United States," for August and September, have been received; also a special report on "Fruit Culture in Foreign Countries." The fruits considered are the orange, lemon, olive, fig and the vine.

"Prospectus of the National Electric Light Association," has been received from Secretary Allen R. Foote. It is published by order of the executive committee, and contains a prospectus, the constitution, names of officers, committees to report at the thirteenth convention, lists of active and associate members and a review of the proceedings of the executive committee.

"Ice-making and Refrigerating Machinery," is the title of a handsome book sent out by the Frick Company, Waynesboro, Pa., as a catalogue of their machinery for such purposes. It is more than a catalogue. The literature on this subject is limited, both in quality and quantity. In this volume the subject is thoroughly presented from a practical point of view, on scientific lines. It is a valuable volume to those interested in such matters.

"Statistics of Railways in the United States," has been received from Mr. Edward A. Mosely, secretary of the Interstate Commerce Commission. It embraces the second annual reports of the railways of this country to the Interstate Commerce Commission for the year ending June 30, 1889. It is very complete in statistics and general information, and is doubtless the most reliable volume on the subject extant.

"Legal Hygiene; or, how to Avoid Litigation," by A. J. Hirschl, is published by Egbert, Fidlar & Chambers, Davenport, Ia. The work is built on the principle that "an ounce of prevention is worth a pound of cure." It is not a form book, nor is it written in the complete-guide-to-universal-law style. The author advises the reader in a pleasant, chatty way, entirely free of technical expressions, which is at once interesting and instructive.

CORRESPONDENCE.

OUR CINCINNATI LETTER.

A Conservative, but progressive and successful business man expressed himself to your correspondent as follows: "Cincinnati is, in my opinion, on the verge of one of its periods of rapid and healthy advance. I don't mean a boom. Cincinnati doesn't have booms; we make the money here for booms in other places. But we have our seasons of growth and our interims of preparation for another. Why shouldn't the city grow? As a railroad center, Cincinnati is among the favored cities of the country. Look at our electric railways in daily operation and more building. The electric light is coming into more general use every day. Our telegraph and telephone systems are among the very best. We have four bridges across the Ohio, one in process of construction, and another in contemplation. These are the paths to cheap homes in the little river towns of Kentucky, which attract large numbers of our laboring classes. We have the best markets in the world, and living expenses here are very low. The city is growing and will continue to grow."

The Overhead System of electric railways has secured a firm foothold here. The *Commercial Gazette* recently gave this as its editorial opinion: "Overhead wires on electric railways have their objectionable features, but are better than none of those swift street cars would be."

Clifton Electric Railway.—The immediate construction of an electric railway from the city to Clifton, one of the most beautiful of the surrounding suburbs, seems to be assured. A committee of wealthy Cliftonians have the matter in hand and is pushing the scheme to a successful issue.

The Rosedale Electric Street Railway is said to have secured the privilege of running its cars from Covington, Ky., over the Chesapeake & Ohio Railroad bridge into Cincinnati. This will furnish Kentucky suburban residents with much desired rapid transit.

The Hartsfeld Furnace and Refining Company is a new corporation with $10,000 capital. The company, among other things, will smelt and refine aluminium. The incorporators are Charles L. Hartsfeld, William A. Lampe, Herman Nagel, George Heinlein, Jr., and George R. Hildebrand. The officers are Herman Nagle, president; George Hildebrand, vice-president; C. L. Hartsfeld, treasurer and manager; William Lampe, secretary, and George Heinlein, superintendent.

The Cincinnati Gas Fixture Company, 213 West Fourth street, was recently awarded a $10,000 contract for the combination gas and electric fixtures for the new court house at Evansville, Ind.

At Fifth and Walnut Streets, Post Office Square, occurs a combination of motive powers not often encountered. At this busy corner the tracks of several horse car lines, two cable roads, a double trolley electric road, and a single trolley electric road meet, cross and recross in a manner bewildering to the pedestrian. The clanging gongs and number of cars gives this vicinity quite a metropolitan appearance.

Several Citizens recently sent a letter to the city solicitor asking him to bring suit against the Edison General Electric Company to restrain the company from installing an underground electric lighting system in this city in accordance with a decree granted the company on April 4th, 1890, by the Probate Court. The usual grounds of abuse of corporate power, tearing up of streets, etc., were taken by the complainants. The city solicitor refused to bring suit.

The John Shillito Company, one of the largest dry goods houses in the West, makes a novel use of the incandescent light in the lace and ribbon department. These dainty creations are displayed in glass show cases, from which a mellow glow of light proceeds. The effect is produced by placing the incandescent lamps on the bottom of the case and surrounding and covering them with a filmy lace handkerchief or some such finery.

Cincinnati, Nov. 10th, 1890. S. L. C.

OUR ST. LOUIS LETTER.

The Street Railways continue to be the chief topic in electrical circles. The Short system on the Seventh street branch of the Broadway line is now operating very smoothly. The Lindell Railway Company are just getting their roads into shape. The Fourteenth street branch is at present running by electricity, as are also two of its western branches, *i. e.*, the Forest Park and Fair Grounds, and so soon as sufficient power can be had the main line will be put in operation. All the wiring and track construction is completed and their full complement of Brill motor and trail cars are received. Mr. Capen does not think the power house will be entirely finished until January 1st, 1891. The company has adopted an electric gong for the motor cars and have placed the new "St. Louis" register on all their cars. I understand their Vandeventer line is not only going to be built as far south as Tower Grove Park, but that an extension from its present northern terminus at the Fair Grounds will be made as far north as Bellefontaine. The Missouri Railroad Company are just getting their power house in condition. The generators have all been placed in position and the engines are being put in.

Track Construction is rapidly going on on the Mound City line. All the motor cars for this company are of the St. Louis Car Co.'s make. The cars are at present being operated on the Union Depot line. This latter road has completed the wiring of its downtown loop, and is now operating on Broadway, the principal thoroughfare of the city. A recent addition to some few of the motor cars is attracting much attention. It is the vacuum air-brake. The cylinder is placed on the roof of the car, which gives the car a peculiar appearance. It is working very satisfactorily.

Somewhat of a Sensation was caused here recently by the dismissal of four of the oldest and best operators on the Western Union circuits. The official reason given was that their work "was not satisfactory," but it is generally believed that it was owing to their connection with the Brotherhood.

The Missouri Electric Light and Power Company are making some very extensive improvements in their plant. This is due to the large increase of business.

The Union Electrical Construction Company have their hands full trying to keep up with their orders for construction work. Some of their recent work comprised the fitting up of Woodward & Tremain with 225 lights, of the Crown Linseed Oil Company with a 90 light dynamo and 100 incandescent lights and an order for a 150 light dynamo. They have just secured the agency for the Purdy Manufacturing Company.

Now that the Exposition is over and the general public is satisfied, rumors not at all complimentary to the management of the electrical department are floating about.

Mr. T. J. Wilson, president and manager of the Western Electrical Supply Company, of St. Louis, has, in conjunction with Jas. Benson, S. S. Dwight and others, organized the Centralia Electric Light and Power Company, of Centralia, Ill. They have a ten years' franchise for lighting Centralia, and will soon put up a $10,000 plant.

It is reported that St. Louis parties have asked for a conference with representatives from St. Charles, Mo., to consider the erection of an electric road to run from St. Louis to St. Charles, a distance of 27 miles.

Suburban Notes.—East St. Louis, Ill.: Work is rapidly progressing on the Broadway portion of the new electric road. An effort is being made to get permission for the road soon to operate from Belleville to East St. Louis to run on some of the streets now used by the rival electric line. Altoona, Ill.: The stockholders of the Altoona Improvement Association have taken the proposition of the Holmes syndicate to buy their lines. The lines are soon to be converted into electric roads and will be much extended.

St. Louis, Nov. 12, 1890. W. H. B.

OUR BOSTON LETTER.

Mr. S. E. Barton, president Electric Mutual Insurance Company, starts from this city on Wednesday next for an extended business trip through several of the Southern States.

Mr. Frank Harrington, the New York representative of the Tropical American Telephone Company, arrived in town this evening. His few days' sojourn at the "Hub," as contemplated will enable him to visit many of his old friends and business associates.

Mr. Morgan Brooks, secretary and treasurer of the Electrical Engineering and Supply Company, St. Paul, Minn., was in Boston recently, and kindly favored this office with a visit.

Messrs. Murray & Tregurtha, electrical and mechanical engineers, this city, have leased a factory No. 97 Oliver street, and equipped it with new machinery. This firm has gained a widespread reputation for the excellence and reliability of their work.

Mr. H. M. Underwood, general agent Interior Conduit and Insulation Company, of New York, has charge of his company's attractive exhibit at the Mechanics' Fair, now being held in this city.

Mr. John T. Bradbury, a representative of the Thomson-Houston Motor Company, has invented a storage battery which is attracting a good deal of attention and favorable criticism from electrical experts, who have seen it practically tested. Patent has been applied for, and full particulars will be published in these columns at an early day.

The Thomson-Houston Motor Company, through its representative, Mr. John T. Bradbury, has sold a 20 horse-power motor to the Messrs. Doherty Brothers, Lowell, Mass., for driving the machinery in the extensive factory of that firm.

The Thomson-Houston Electric Company's isolated department recently sold a 450 light incandescent plant to the Merrimac Manufacturing Company, Lowell, Mass., and the lights were started up on the evening of November 10th. The Electric Company's Lowell agent, Mr. J. T. Bradbury, placed this order.

The New Electric Light Station at Wakefield, Mass., started up last Monday evening with 250 horse-power capacity. It will now run its lights permanently, having previously (on September 16th) been given its initial lighting up of a few lights so as to conform with the Massachusetts law.

Milford, Mass., will soon have an electric line to Hopedale. The rails are about laid and work has been commenced on the power house. This line will not use overhead wires.

Col. A. N. Sampson, general manager of the New England Phonograph Company, lectured before the Franklin Typographical Society, in this city, Friday evening, October 31. Subject was on phonographs, giving various reproductions and affording a delightful and highly appreciated entertainment.

The Bird & Sloane Electric Construction Company has been incorporated under the laws of Maine with a capital of $30,000. The officers are: President, Thos. J. Howe; treasurer, John F. Polsey; secretary, Roswell P. Smith; and managers, Wm. H. Bird and Geo. H. Sloane. Offices have already been established at No. 620 Atlantic avenue, Boston. The company will do wiring and construction business, giving especial attention to isolated plants.

The Waltham Electric Clock Company is preparing for active manufacturing at Natick, Mass. The carriage factory building on North avenue has been secured and will be occupied as fast as possible. By the last of next month, it is expected to have a good number of men at work. At present the work is done elsewhere. Some of Natick's prominent men have interested themselves in this new company. The new form of clock soon to be manufactured, is certainly an apparent radical departure from the present style of clock. Winding is entirely dispensed with. An electric battery is concealed in the clock and motion is given to the pendulum by simply opening and closing the circuit, in which action a little magnet assists. Charging the battery occasionally is all the care needed. The clocks are to be manufactured by the Waltham Electric Clock Company, at Natick, Mass.

Whitman, Mass., is to have more electric lights. The people like it, and demand additional electrics for both street and commercial purposes. The enterprising company which furnishes the improved illuminant will erect a new station, and has broken ground for this purpose. The present capacity of company's plant is 25 arc and 300 incandescent lights for street lighting, 13 arc and 570 incandescent commercial lights. All of these are in use, and orders in hand for many more. When the equipment of new station is in position, the lighting capacity will be nearly double that now in operation. Compound condensing engines will be used. W. I. B.

Boston, Nov. 15th, 1890.

OUR CHICAGO LETTER.

The Electric Construction and Repair Company, whose notice of incorporation was recently published in the REVIEW, have secured floor space in the well-known Springer building, on Canal street, Chicago, and have commenced the manufacture of a number of new novelties in street railway devices which will soon be placed on the market. The gentlemen who are interested in this new venture are well known in electrical circles. Everything is in working order in the new factory, and the announcement is made that they are ready to make proposals for the entire construction of street railway, power, arc or incandescent plants of any system. Mr. C. M. Barclay, the president of the company, has secured the agency of the well-known Perret motors and dynamos.

The Western Office of the "Review" is in receipt of a very fine picture of the Westinghouse Electric & Manufacturing Company's plant at Pittsburgh, Pa. The picture is nicely framed, and makes a neat piece of office decoration.

The Suit Brought against the Hazleton Tripod Boiler Company, of Chicago, by the Hazleton Boiler Company, of New York, in which they ask that the former company be restrained from using the name Hazleton, was decided in favor of the Chicago company in the Appellate Court this week.

Personal.—J. B. Wallace, of Ansonia, Conn., was a recent visitor in the city.—Geo. B. Shaw, of Eau Claire, Wis., general manager of the National Electric Manufacturing Company, spent a few days this week in Chicago.—W. W. Hess, manager of *The Car*, was a recent visitor at the Western office of the REVIEW.

The Contract for the complete equipment of the Maywood Electric Light and Power Company's plant, has been let to the Thomson-Houston Company.

Theo. P. Bailey, manager railway department, reports the following sales of the Thomson-Houston perfected snow sweeper: Three to Union Depot Railroad Company, St. Louis; two to Missouri Railroad Company, St. Louis; one to Citizens' Street Railroad Company, Indianapolis, Ind.; one to Omaha, Council Bluffs and B. Company, Council Bluffs. D. B. D.

Chicago, Nov. 15th, 1890.

PERSONAL.

Mr. J. E. Talbott, of the Fort Wayne Electric Company, one of the well known electric light men of the day, was a visitor in the metropolis last week.

Mr. Frank Laughlin, the active young business manager of the Solar Carbon Company, of Pittsburgh, was a New York visitor last week and made a welcome call on the ELECTRICAL REVIEW.

Mr. Gilbert M. Smith, the wide awake manager of the Chicago office of that highly successful company, the Ansonia Brass and Copper Company, gladdened his New York friends by a visit of several days recently.

Mr. Theo. Mosher, of the Mosher Arc Lamp Company, Chicago, has been a New York visitor for several days, having arranged with Messrs. Alexander, Barney and Chapin to handle his lamp in this section.

Mr. Chas. E. Gibbs, who has been the traveling representative of the Rodney Hunt Machine Company, Orange, Mass., has been made superintendent of the works. He had previously filled this position for a term of 12 years.

Mr. John I. Sabin, the energetic and successful telephone capitalist, of San Francisco, is spending a few weeks in New York enjoying life at the Electric Club. Although he has recently been elected to a political office, his Eastern friends still speak to him.

Mr. Cyrus O. Baker, Jr., accompanied by his wife, sailed from Liverpool on the "Majestic" Wednesday of last week, and is expected to arrive here Thursday, November 20. Mr. Baker's many electrical friends in this country will be glad to hear of his safe return.

Col. S. M. Bryan, the alert telephone man of Washington, D. C., paid New York a flying visit last week. The energetic colonel is in the midst of comprehensive underground work for his big exchanges in Baltimore and Washington, and whatever is done in this direction by him will most assuredly be done in a first-class and substantial manner.

Brooklyn Institute.

"Submarine Telegraphy" formed the subject of a lecture delivered by Mr. Herbert Laws Webb, of the Metropolitan Telephone and Telegraph Company, before the members of the department of electricity of the Brooklyn Institute at the regular meeting held on Friday last.

Mr. Webb gave an interesting resumé of the early history of submarine cable laying, which commenced with the submersion of a gutta-percha covered wire across the Straits of Dover, in the year 1850. The numerous unsuccessful Atlantic expeditions a few years later, and the final laying of the Atlantic cables in 1866 were reviewed as forming a memorable epoch in the history of telegraphy.

The lecturer then described the construction of a telegraph cable, and pointed out the immense improvements that had been made in every item of the manufacture since the early days of the art. Cable ships, their machinery, tanks and equipment and the staff on board, were touched upon, and the important and highly interesting work of surveying the route for a proposed cable was described very fully. After this the audience were shown how a cable is landed and made fast on shore, how it is paid out and the end buoyed at sea, how a broken cable is grappled, picked up and repaired, and in fact all the vicissitudes in the history of a telegraph cable were described by the lecturer and illustrated by means of lantern slides.

Scarcely any detail of the work was omitted, and a thoroughly practical and exhaustive account of the methods of creating and maintaining ocean telegraphs was given.

The Short Electric Railway Company report the following contracts for the two weeks of November (to the 15th) for electrical equipment: The Schuylkill Electric Railway Company, Pottsville, Pa.; Watervliet and Turnpike Railway Company, Albany, N. Y.; Texarkana Street Railway Company, Texarkana, Ark.; Lindell Avenue Railway Company, St. Louis, Mo.; Syracuse and Onondaga Railway Company, Syracuse, N. Y.

Telephonic News

*** On November 1, 1890, the business of the Fresno, Cal., Telephone Company was transferred to the Sunset Telephone and Telegraph Company, of San Francisco.

*** The Erie Telephone Company's subcompanies now employ 660 people regularly—in Minnesota and Dakota, 215; in Cleveland, 131; and in Arkansas and Texas, 314.

*** Telephone lines are being rapidly extended in the South. Arrangements are being made by which a line will be continued from Juno down Lake Worth as far as Palm Beach, Florida.

*** The Rochester, N. Y., Bell Telephone Company objects to having its poles used by the Rochester Street Railway Company on West avenue, and threatens to bring suit if the poles are attached to in any way.

*** The city of Vicksburg, Miss., has determined to remove all telephone and telegraph poles, and having notified the Great Southern Telephone Company at divers times, without effect, to change their location, will begin hewing them down this week. It is expected that an injunction will supervene, and that the matter will be fought out in the courts.

*** At Boston, last week, before Judge Thompson, a jury awarded the plaintiff $2,500 in the case of Mary A. Stiles *vs.* The New England Telephone and Telegraph Company, an action in which the plaintiff sought to recover damages for injuries caused by a coil of wire falling upon her while she was passing along Harrison avenue one day in November, 1888.

*** A further development of the idea of transmitting a concert programme over a telephone wire to any desired location was recently made in New York. A concert was given in the transmitting room of the American Telephone and Telegraph Company, and the whole of the music was simultaneously listened to by six audiences, one in Philadelphia, one in Baltimore, one in Newark, one in Morristown, N. J., and one in Brooklyn.

*** In the financial column of the Boston *Herald*, on October 10, was published quite a long account of the affairs of the Mexican Telephone Company, in which it was represented that Mr. Harrington, who is a director, secretary and the attorney of the company, had, under the authority of the board of directors, completed an investigation of affairs in Mexico, and discovered abundant evidence of mismanagement and had instituted certain reforms, including the dismissal of Mr. Guiraud from active management of the property. Severe reflections were cast upon Mr. Guiraud. To these criticisms of himself and his management Mr. Guiraud has recently made a reply in which he gives a brief history of the company and explains certain of its business transactions. He says there is yet time to save the company, and states that he can justify all his actions as a director.

*** The following invitation is being sent out to the subscribers of the Cortlandt street exchange, New York city, and a large number of people have already accepted it. The invitation is self-explanatory:

Dear Sir—You are cordially invited to visit, at your convenience, our exchange at 18 Cortlandt street. We think you would be interested in witnessing the practical working of the telephone system in our operating room, where the largest and most expensive switchboard ever constructed is in use, and we believe the visit would result in mutual advantage in our relations. An exchange of suggestions as to use of the telephone, between officials of the company who are devoted to the subject in hand, and subscribers who are relying upon the telephone system as an important business necessity or social convenience, may contribute toward improvement in service.

Very respectfully,
DAVID B. PARKER,
General Manager.

Automatic Pay Station for Telephones.

An interesting example of the great variety of "coin in the slot" machines being introduced to public notice is found in a device invented by Howard C. Root, of Brooklyn, N. Y. The machine enables any individual desiring to use a public telephone to introduce a coin varying from a nickel to a dollar within the slot of the machine, and thereby cause the machine to transmit intelligence to the central office as to the value of the coin deposited, thus enabling an operator at the central office to limit the time during which the telephone may be used by the customer. The accompanying engravings illustrate the construction of the apparatus. It comprises essentially a series of inclined guideways or chutes arranged within an enclosure or box along which the coin introduced through the slot may roll. A series of contact fingers arranged at different distances above the bottom of this inclined chute are pivotally supported so that the coin in rolling over the bottom of the chute will displace one or more of the contacts, according to its denomination or value. The upper ends of these contact fingers are maintained by springs normally in electric contact with backstops and are all included in a local circuit including the primary of the induction coil and the transmitter, so that when the lower end of any one of the fingers is struck by a coin passing through the chute the upper end of the finger will break contact with its back-stop, thus opening the transmitter circuit and sending an induced impulse over the line to the central station. As it is desirable that no one contact finger be struck by both the largest and smallest coin, guards are provided, marked g, g^1, g^2, in the engraving, Fig. 2, which are arranged over the different contact fingers at different heights from the bottom of the inclined chute so that some of the larger coins will run over these guards and be thereby prevented from making contact with the fingers intended to be operated by the smaller coins. In order to reduce the number of contact fingers some of them are forked into two or three points lying over or under guards of different heights; for example, the first contact finger at the top of the apparatus has only one point, adapted to be struck by a ten cent piece, and is protected by a guard strip g, at such a height from the bottom of the chute that a larger coin will ride upon the guard, and consequently will not strike the finger. The second contact finger has two points, the lower of which behind the guard piece g will also be struck by a ten cent piece, while the upper point lies over the top of the guard strip g, so that it will be struck by a five cent piece only. Over this upper finger is a second guard strip g, at a greater distance from the bottom of the chute, which will prevent larger coins from striking either prong of the second finger. By means of this system of guards and contact fingers, a single chute serves for all sizes of coins, and in the particular arrangement illustrated, a nickel would break the circuit once, a dime twice, a quarter three times, a half dollar four times and a dollar five times, in passing through the chute. The chute is mounted upon a board B^1, which is inclined from the top to the bottom, so that any coin in passing through the chute will be preserved by gravity in the proper plane of movement. The points of the fingers are arranged at such heights from the inclined board supporting the chute, and are so protected by the guards that a one cent piece or a two cent piece would not strike any of the fingers. The operator at the exchange is advised when a coin is being introduced by a closure of a local circuit, including an alarm bell H, when the coin is being introduced in the slot, the sound waves created by the bell acting upon the transmitter and being communicated through line to the central office. In order to know when the coin has passed entirely through the chute, and to prevent fraud by manipulation of the hanger switch, a spring trough J is supported at the bottom of the instrument so that the bell H will be rung by a closure of its circuit after the coin has passed through the chute, thus advising the central office operator that the cash has been paid and the customer is entitled to service.

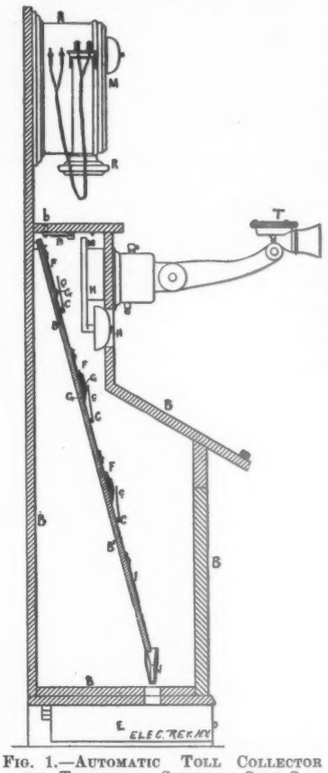


FIG. 1.—AUTOMATIC TOLL COLLECTOR FOR TELEPHONE SERVICE.—SIDE SECTION.

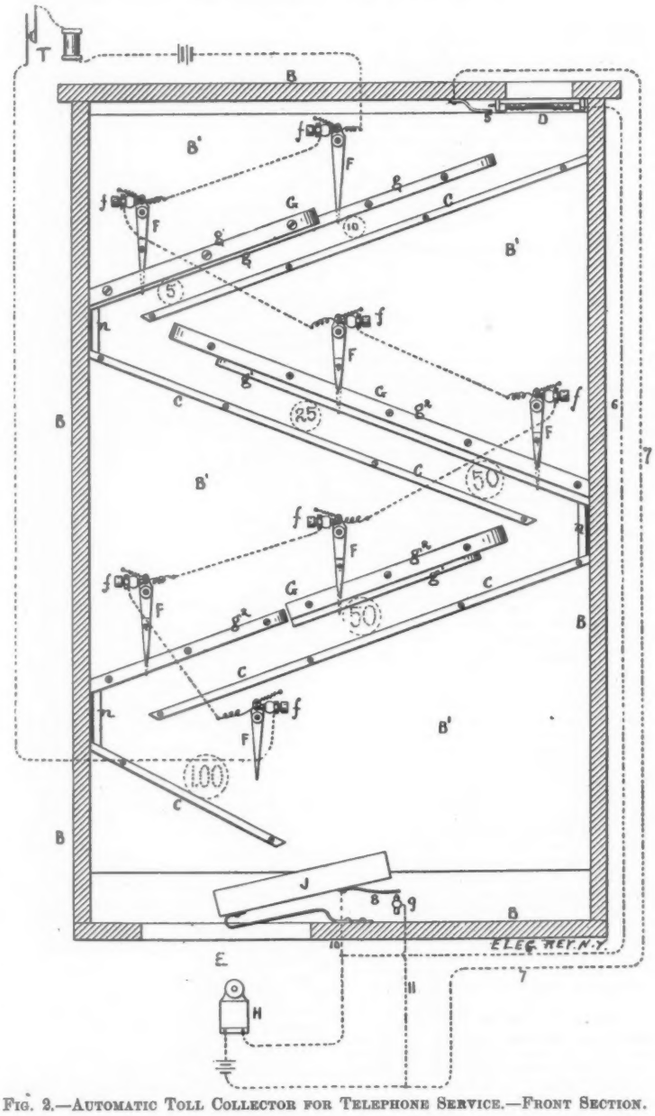


FIG. 2.—AUTOMATIC TOLL COLLECTOR FOR TELEPHONE SERVICE.—FRONT SECTION.

A Dog and a Telephone.

A novelty in a Harlem beer garden is a dog that talks into the telephone, says the New York *Sun*. The proprietor lives over his saloon, and when a thirsty crew of sufficient size enters the place, the dog, Tim, is trotted out to entertain the crowd and put them in a generous mood. The minute Tim hears the bell he gives a bound and takes up his position on a high stool in front of the mouthpiece, ready for business. Connection is made with the proprietor up stairs, and the fun begins.

"Hello, Tim, is that you?"
"Bow-wow."
"Speak, you rascal."
"Bow!"
"Sit up and beg for the gentlemen." [He does so.] "Rats, Tim!"

Away goes Tim, down on the floor, and after scurrying around for a minute, back he comes again, eager for more sport.

"Tim, how many drinks have the boys ordered?"
"Bow, wow, wow, wow, wow, wow!"
"Good dog! Sing for the gentlemen!"

Hereupon Tim howls.

"Tim, you're a chump."

Tim snaps, snarls and shows his teeth. All in all, it is a remarkable dog, and worth a heap of money to his master, but doubtless Tim will have a pack of imitators, and then his greatness will wane.

Annunciator Suit.

The Western Electric Company, of Chicago, have brought suit against Christian Ruppert, of Washington, D. C., to compel him to pay over to them all gains and profits realized by him from the sale and use of an electric annunciator for elevators, which it is alleged, is an infringement of a patent owned by the company. It is set forth in the bill that the Western Electric Company obtained from the Western Electric Manufacturing Company patents No. 172,993, and 148,447. A decision was rendered by Judge Blodgett, of the United States Court, sustaining the validity of each of said patents and fixing the complainants' damages at $200.

Telephonic Specific Inductive Capacity.

In an article under the above heading in your last issue, Mr. W. W. Jacques points out that there is a considerable difference between the telephonic and the telegraphic specific inductive capacity of certain materials.

After describing some experiments made by himself and others upon various dielectrics, he gives a table showing that the telephonic capacity of all the samples tried, except one, is HIGHER than the telegraphic capacity of those samples.

Surely this is not quite correct.

All theory and practice, except Mr. Jacques', so far as I am aware, tend to show that the capacity of any dielectric is LESS when measured by currents of short duration—*e. g.*, telephonic currents—than when measured by currents of longer duration—*e. g.*, telegraphic currents—owing to the "absorption effect" noticeable when any dielectric is charged for an appreciable time.

This is clearly explained in most textbooks upon the subject, and is noticed even in the authority quoted by Mr. Jacques, viz: "Gordon's Electricity and Magnetism," Chapter 11. On pages 99 and 103 of the second edition, experiments are described and figures given which clearly show that Mr. Jacques' deductions are not correct.

Again, on page 109, we read: "*The capacity increases if the electrification is continued*—at first rapidly, then more slowly," etc.

As the question is of considerable importance in long distance telephony, and, as an earlier edition of the same article has been published in your journal of 21st March last, page 314, without any one drawing attention to the inaccuracy of the results contained therein, I think an explanation is due from Mr. Jacques as to how his experiments were made, and also as to how he arrives at the "calculated results" given in the middle column of the table referred to. —*J. W. Ullett, in London Electrical Review.*

A Telephone Memorandum Roll.

No doubt, every user of a telephone has felt more than once the want of a convenient means of taking down messages. Tatum's telephone attachment, illustrated on this page, seems to satisfy this want. The device speaks for itself. It may be mentioned, however, that as the telephone companies

TATUM'S TELEPHONE ATTACHMENT.

forbid the defacing of their instruments, the pad is attached without the aid of screws, and yet a solid bearing for the hand is afforded. The paper is fed from a roll, so that there is no waste. The board is made of walnut, with nickel-plated trimmings. Tommins & Adams, 116 Chambers street, New York, are the sole agents for Tatum's telephone attachment.

Inspector of Electric Wires.

Providence, R. I., is to have an officer to be known as Inspecter of Electric Wires, with a salary of $2,250. No one is to be eligible to the office who cannot pass a satisfactory examination before an examining board of electrical experts. The duties of the office will be principally the inspection and supervision of electric wires and conductors, and to make each year a report to the city council embodying such recommendations as may be thought necessary to increase the public safety.

Telephone War in Ontario—Free Telephones.

The local company which was formed in Peterboro', Ontario, with a capital of about $8,000, and with the avowed intention of doing business at half the rates charged by the Bell Telephone Company, and paying a much larger dividend than the shareholders of the Bell Telephone Company ever received, has apparently discovered, after all its construction work has been done, that the big company has not the slightest intention of giving up the field to it.

The tactics pursued by the first comers are simple in the extreme. They have waited until the little company had spent what was supposed to be the amount of its capital, and now announce that they will give all their old subscribers, who are not interested as shareholders in the attempt to wreck their business, and all new subscribers who are likely to remain with them, free telephone connection as long as the opposition lasts.

The officials of the Bell Company say this attack on them is a wholly unprovoked one, as no complaints were made of the service in Peterboro', which was excellent, and the regular rates charged by them are the lowest in the world for exchanges of the size; and also that any one who will take the trouble to make a few enquiries, could find out in five minutes that the item of rent and salaries absolutely necessary for the proper conduct of the business, would alone eat up all the revenue of a cheaper-rate company, leaving nothing whatever for the equally necessary expenses of heating, lighting, stationery, interest on course of construction and allowance for depreciation, accidents and damages, and last, but not least, repairs.

In addition to ordinary repairs, a heavy and continuous expense, one good storm will often do damage enough to use up the surplus revenue of a single agency for years. —*Kingston News.*

Storage Battery Patent Suit.

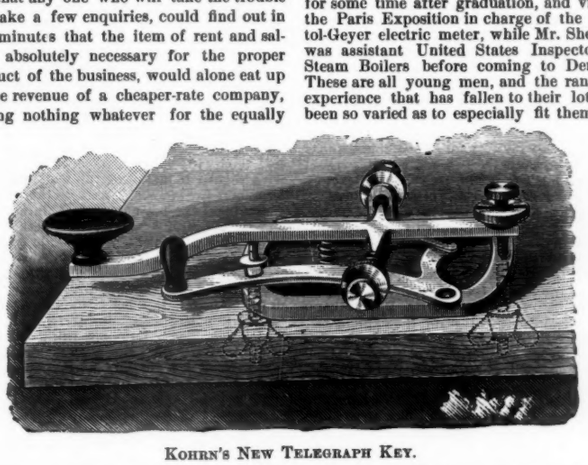
Suit has been brought in the United States Circuit Court for the Southern District of New York, by the Brush Electric Company and the Consolidated Electric Storage Company, of New York, against the Anglo-American Electric Light Manufacturing Company, for alleged infringement of certain United States patents known as the Brush storage battery patents owned by the former companies. A preliminary injunction has been asked for.

The Boston *Advertiser* is told from a semi-official source that under the new contract with the American Bell Telephone Company new construction in the Northwestern and Cleveland Companies is provided for by a new issue of stock in the companies, which is taken and paid for by the American Bell and Erie in ratio to their holdings. The expense account includes all disbursements, except cost of construction, arranged for as above. If the cost of this construction had been included in expense as before under the old control the surplus would show about $6,000 quarterly. Erie as a whole is maintaining its four per cent. dividend, paying the American Bell its proportion and meeting every expense of operating and construction, reserving $6,000 quarterly. This amount will increase with the growing receipts as expenses have not increased in an excess ratio.

Thomas, Shepard & Searing.

Mr. Charles G. Thomas, who for a time acted as our correspondent in San Francisco, has recently established himself in business in Denver, Col., with Mr. Frank E. Shepard and Mr. Lewis Searing, under the title of Thomas, Shepard & Searing. The firm intends to make the higher engineering work of mechanical and electrical matters their profession, and will give special attention to the following classes of work: Tests of engines, boilers, machinery and electrical apparatus; experiments and researches on material and processes; development of inventions and design of plants and special machinery; examination and reports on existing and projected manufacturing plants and processes; supervision of the erection of machinery.

Messrs. Thomas and Shepard are graduates of the Massachusetts Institute of Technology, while Mr. Searing holds a diploma from the Stevens Institute, at Hoboken. Mr. Thomas was connected with Mr. Edison at his private laboratory at Orange for nearly a year, and has also been the San Francisco agent of the Thomson-Houston Company. Mr. Searing was in the private laboratory of President Morton, of Stevens, for some time after graduation, and visited the Paris Exposition in charge of the Bristol-Geyer electric meter, while Mr. Shepard was assistant United States Inspector of Steam Boilers before coming to Denver. These are all young men, and the range of experience that has fallen to their lot has been so varied as to especially fit them for the work that they have chosen. We take pleasure in calling the attention of the electrical fraternity of the West to the firm, and are confident they will meet the success that they so richly deserve.



KOHRN'S NEW TELEGRAPH KEY.

A New Telegraph Key.

In the accompanying engraving is illustrated a telegraph key recently patented by Mr. Wm. A. J. Kohrn, of San Francisco. The novel feature of the key consists of a pivoted switch provided with a beveled arm, which co-operates with a spring tongue attached to the rear end of the key lever, so that when the switch is thrown to its closed position the beveled arm will bear upon the spring and force the rear end of the key upwardly, thus closing the circuit and making a safe contact. The device insures the closure of the circuit at the key so that it prevents the lodgment of dust upon the circuit closing contacts, and thus reduces the liability of trouble from that cause.

Imitating Globular Lightning.

The phenomenon of globular lightning was imitated by M. Planté, it will be remembered, with his secondary batteries. It has been shown by Herr von Lepel, as we learn from *Nature*, of October 16th, that this can also be done with so-called statical electricity, obtained from an influence machine. Two thin brass wire points from the poles of a powerful machine being held at a certain distance from the opposite sides of an insulated plate of mica, ebonite, glass, or the like, there appear small red luminous balls, which move about, now quickly, now slowly, and are sometimes still. Even better effects were had with a glass or paper disk which had been sprayed with paraffine. Small particles of liquid or dust seem to be the carriers of the light. A slight air current makes the spherules disappear with hissing noise. These spherules, the author remarks, are phenomena of weak tension; an increase of the tension gives a rose spark discharge. Various interesting analogies with globular lightning are traced.—*Science.*

TELEGRAPHIC

.... The new wire being put up by the Western Union Telegraph Company, which will connect San Francisco and other points on the coast with Chicago, has reached Fresno.

.... The North American Telegraph Company has connected its West Superior, Wis., office by direct quadruplex wires with Chicago and St. Paul, and has arranged for direct service to New York when occasion requires.

.... Joseph Chitwood, telegraph operator at Akron, Ala., was shot in the back of the head by some unknown person while he sat at work at his table on the night of November 7. He will die. There was a broken pane in the window at Chitwood's back, and the assassin fired a load of small shot from a gun through the hole. The shot took effect in Chitwood's head and back, and, although he is still alive, the physicians have given up all hope of his recovery. There is absolutely no clue to the identity of the murderer.

.... The St. Paul, Minn., council committee on streets recently voted that the Western Union Telegraph Company be compelled to put its wires underground. The company protests that it cannot operate its wires successfully now underground on account of the long circuits. The city attorney has been instructed to draw up an ordinance providing for placing the wires underground. It will be reported to the next meeting of the council. The company proposes to put in 40-foot poles instead of 60-foot poles, with two cross-arms instead of 12, and four cables instead of the present network of wires.

The Vibrations of a Platinum Wire Kept Incandescent by an Interrupted Electric Current.

BY M. ARGYROPOULOS.

I stretched, horizontally, a platinum wire .7 of a metre in length and a fraction of a millimetre in diameter, and sent an electric current into it, in order to heat it to white heat. Observing the great dilatation of the wire during the passage of the current, I thought that some vibratory movement would be produced by successive interruptions of the current. I, therefore, introduced into the circuit a large trembler interrupter, or, better still, the interrupter proposed by Foucault for large Ruhmkorff coils; the platinum wire immediately began to vibrate, subdividing itself into stationary waves.

We can observe very clearly one, two, three, and as many as eight, ventral segments separated by nodes which seem to be stationary. By very slowly lessening the tension of the platinum wire the number of these ventral points is increased; on the other hand, if we slowly increase the tension, the number of ventral points is lessened, and the incandescent wire vibrates transversely, forming a single ventral segment in the middle.

The support on which I stretched the wire had two actions, one to stretch the wire more or less, and the other to lengthen or shorten it.

The experiment was performed in the following manner: First, I took a long length of wire and sent through it a current of from 45 to 50 Bunsen elements, keeping the interrupter inoperative. Then the wire was shortened until it became incandescent. The interrupter was then set in motion and the wire began to vibrate. Then the wire was slowly stretched, until at last it vibrated as a whole, forming one single ventral segment in the middle. By lessening the tension of the wire I could produce as many as eight ventral segments, or even more.

This experiment enables us to illustrate before a large audience the vibratory movements of strings.

* * The Bloomington, Ill., electric railway is now in operation.

* * An electric railway from Mason to Dansville, Mich., is being talked about.

* * It is proposed to connect Bridgewater and Brockton, Mass., by an electric road.

* * Oscoda and Au Sable, Mich., decline to put up a bonus of $5,000 to secure a street car line.

* * The Plainfield, N. J., common council has issued a call for bids for an electric railway system. Bids must be entered before November 24.

* * The Peru, Ill., *News-Herald* now runs its new Campbell press by electricity, and the Augusta, Ga., *Chronicle* is installing a 10 horse-power "C. & C." motor to operate its presses.

* * It is reported that the sales of the Westinghouse Electric Company in October were $1,718,000, of which $687,000 was air-brake business and $500,000 electric and manufacturing business.

* * The electric road running between East New York and Jamaica, L. I., is daily taxed to its utmost capacity, and, as a measure of necessity, three more cars will be put on this Winter.

* * The Adrian, Mich., Electric Railway Company has asked for the privilege of carrying freight over its lines between 9 P. M. and 6 A. M., for the accommodation of shippers at a distance from the freight station.

* * It is rumored that negotiations for the location of a plant at Kankakee, Ill., for the manufacture of electric light and power machinery are well under way, and that in all probability the contract will be closed this winter and work commenced next spring.

* * The stockholders of the Citizens' Horse Railway Company, and those of the St. Louis and Belleville Railway Company, will hold a meeting on Saturday, January 10, 1891, for the purpose of submitting to those interested in each the proposition of consolidating the two companies.

* * The stockholders of the Union Street Railway Company, of New Bedford, have received communications from President Samuel C. Hart, stating that a syndicate has offered to take their stock at $155 per share, and asking them to turn in their shares to Hon. William W. Crapo, in case they decide to accept. Most of them have already done so, and, it is said, the sale will be consummated in a few days.

* * The Thomson-Houston Motor Company has just installed an electric drum hoist at the docks of the Merchants' and Miners' Transport Company, Boston. On the arrival of a steamer of the last named company next Thursday the electric hoist will perform its first practical work, and will then certainly demonstrate its usefulness in as satisfactory a manner as has been evinced at every one of the previous experimental tests.

* * The Brockton, Mass., Electric Railway Company has published its report for the year ending September 30, 1890. The equipment was increased during the year by the purchase of one box car, making the total equipment three box and four open cars, besides an engine, dynamo and other electrical appliances in the power station. The revenue for the year has been: Receipts from passengers carried, $12,553.70; from school tickets, $144.15; other sources, $376.82; total income, $13,074.67. The total passengers carried for the year ending September 30, 1890, was 259,509, being an increase of 27,184 passengers over the previous year, while the increase in passenger receipts is $1,381.90.

Electric Railways.

At the regular meeting of the Chicago Electric Club, on Monday evening, Nov. 17th, the following interesting paper by Theo. P. Bailey, of the Thomson-Houston Company, was read:

The practical development of electric street railways, and their commercial perfection, may properly be said to have been accomplished within two years, and yet there are at the present time 246 electrical street railway plants either in operation or ready to be put in operation within a short time. Two years ago, and even within the past 12 months, we were asked many questions by intending purchasers, which to-day are not even hinted at. Some of the prevailing questions of that age were:

Can electricity be applied in our case?

Can a street railway, equipped with electricity, be made a practical and commercial success?

What will be the life of the apparatus?

What will it cost to keep the apparatus in repair?

Is not the current dangerous to human life?

Will it not ruin the watches of the passengers?

The street railway people to-day appear to have become thoroughly satisfied on these questions, and consider it an idle waste of time to discuss them further. But in lieu thereof they ask us this: "How soon can you furnish the equipment for our road, and what will it cost?" Just think of this statement for a moment: 246 electrical railways in operation, embracing 2,024 miles of track, and 3,830 motor cars, requiring in the neighborhood of 6,400 motors, with a probable aggregate capacity of 174,435 horse-power, employing an electrical generating capacity at the station of about 94,880 horse-power! Did any one of you anticipate two years ago that such a condition of facts could under any circumstances be realized within so short a time? I attribute this wonderful development and success to the following causes:

First, the full practicability of the undertaking; second, the wonderful earning capacity of the electrically equipped car as compared with the horse car; third, a determination on the part of the electrical manufacturers to meet the requirements of the railway companies; and, fourth, the untiring and indefatigable efforts of the exploiter or salesman.

Among the numerous and possibly fatal objections made to the use of electricity, when it was proposed to apply it to street car propulsion, was that grades exceeding five per cent. could not be mounted. But experience and practice have shown that grades as high as 14 per cent. can be ascended with reasonable safety and satisfaction. There is a grade of $13\frac{3}{10}$ per cent. at one point on the line of the street railway at Lynn, Mass., over which 16-foot cars equipped with two 15 horse-power motors are in daily and successful operation. At Milwaukee a grade of $10\frac{3}{10}$ per cent., 430 feet long, is encountered and successfully operated over or upon by 20 foot cars, equipped with two 15 horse-power motors, the total weight of car complete with passengers being $10\frac{1}{2}$ tons. A similar grade is met with at Newport, R. I., and Omaha, Neb., and numerous grades almost as heavy are seen in the electric railway systems at Des Moines and Davenport, Ia., and Kansas City, Mo.

At the present time there are, as nearly as can be ascertained, 957 street railways in the United States and Canada. Of this number 589 are operated by horses, 49 by cable, 246 by electricity, 73 by steam.

It is estimated that the total money value of these combined properties is $164,400,000, proportioned as follows: Horse railways, $58,900,000; cable railways, $49,000,000; electric railways, $49,200,000; steam railways, $7,300,000.

These figures are at best only approximations, as it has been found impossible to secure absolutely accurate information.

This combination of motive powers is doing service over or upon 8,818 miles of track, as follows: Horses, 5,713; cable, 527; electric, 2,024; steam, 554.

I find that the cost per car-mile for the several methods referred to, including all operating expenses and fixed charges, other than interest, is as follows: Horses, 5.7 cents; cable, 2.5 cents; electric, 2.2 cents; steam, 5 cents.

A large majority of the street cars equipped electrically at the present time are mounted upon a single truck, to which are attached one or two motors, as required by the conditions existing in each particular case. The lightest equipment with which I have had to do has been a single 15 horse-power motor upon one truck; and the heaviest equipment has been two 15 horse-power motors upon one truck. The tendency, however, at the present time seems to be in the direction of longer cars, double trucks and heavier motors. This action is prompted very largely, no doubt, by the sad and costly experience of some companies where trailers were used in connection with the motor car; serious accidents, and in some cases death, resulting from injuries sustained by passengers in falling between the motor and trail car while passing from one to the other.

The use of the longer car with double trucks is recommended further as a means of comfort to the passengers, and also on account of the longer life of the car and its equipments. This style of car is, of course, unattended by the oscillating motion found in the shorter car with a single truck. Where the shorter motor car is used with a trailer, experience shows that there is a great loss in wear and tear by reason of the cars jamming together when the brakes are applied. This fault is obviated in the use of the longer car, and while its seating capacity may not be equal to that of two shorter cars, yet it is approximately so. It is claimed further for the long car with double trucks that less energy is required to operate it; also that it saves the expense of one man, decreases the expense of maintenance, and increases the facility for handling passengers.

In treating of the subject of electric railways from a commercial standpoint, I have considered only that branch designated as the single wire overhead system.

For obvious reasons too much care cannot be observed in the planning and locating of the various factors which go to make up a complete electric plant. Assuming that the railway company has secured the desired franchises and rights of way, and have laid out their lines of track so as to avoid all excessive grades, and yet reach the attractive and important points of the town or city, and that they have been fortunate enough to make proper selection of their apparatus, the next important work for them to determine is the location and arrangement of their power station. The selection of a site should be made with reference to obtaining the best facility for handling coal and securing water, and also with reference to the electrical center of the railway system, in order to realize the highest degree of economy in the operation of the plant. The arrangement of the power station is equally as important as its location, with regard to handling the work with the least cost for labor. The selection of the steam plant is a matter of great importance, and should, in my judgment, be left with a thoroughly competent and reliable engineer to determine what particular type of engine, boiler, etc., should be used; and the matter should be left under his direction and care until the installation has been completed. It is manifest that in so doing serious blunders will be avoided. I do not think it can be justly claimed that the railway companies have been too liberal in the amount of horse-power purchased for the operation of their generators. In order to secure the best results, with reference to reliability of service, the horse-power of the engine should be at least 20 per cent. greater than that of the generator which it drives, in order to provide for loss in transmission and excessive loads which are thrown on the generator by reason of a large number of cars starting at the same time; or on account of a ground being accidently thrown upon the line. The steam plant should be so arranged and connected to the generators that either engine or generator may be readily interchanged; and the arrangement of the engines and generators should be made with reference to future extensions. The switchboard containing the indicating and regulating devices, should be located so as to be most accessible to the attendant.

Both the power and electrical plant when complete and ready for operation, should be placed in the hands of men of experience and learning in these departments, in order to insure reliability of service, and the greatest economy in operation and maintenance. I would rather provide in advance for the expenditure of $1,000 or more in this department than to run any risk of having to pay out four times that amount in repairs and losses occasioned by mistakes of incompetent men.

The location and arrangement of the car house is a question of considerable importance, and open to serious mistakes growing out of bad location or improper interior arrangement. Some advantages are secured by locating the car house immediately adjacent to the power station. In this case it may be heated with the exhaust steam from the power plant, and the services of employés utilized in both buildings, and repairs to apparatus concentrated at one point. The car house should be provided with suitable pits for the inspection of the motors and also have proper accomodations for cleaning the car bodies. If the car house is to accommodate more than 20 or 25 cars, it should be provided with running and turning tables, and should also have more than one exit.

I cannot pass from the question of inspection of apparatus without emphasizing the extraordinary importance of having this work done thoroughly by competent and faithful attendants. With electrical apparatus of standard makes we can reasonably expect that a motor car sent out in the morning for the work of the day, having passed through proper inspection, will perform its duty with a degree of certainty that need leave but little, if any, cause for anxiety. This feature is perhaps the most difficult one to impress upon the management of electrical railway companies, more especially where such railways have been converted from animal power. If railway companies will guarantee that degree of care and watchfulness in the operation of their motors indicated above we take practically no chances by giving them the broadest guarantees as to the durability of the apparatus and the cost of maintenance and repair.

It is apparent that in the overhead construction the highest degree of care should be exercised as to its details and arrangement, for this part of the equipment is constantly open to criticism. We cannot blind our eyes to the fact that serious, and in some instances, fatal criticism has been made to this work. We must all avail ourselves of the experience which has attended our efforts and see to it that our overhead construction is not in any case, or for any reason, slighted.

I think an iron pole 28 or 30 feet long, made in three sections of extra strong pipe six inches in diameter at the base, and four inches at the top, provided with wheel base and insulated cap, presents the most sightly appearance on the street and forms the most substantial construction that can be had. Next in reliability and appearance is an octagonal pole of Southern pine suitably painted; and lastly, and the pole most commonly used, the Western Union standard. These poles should be properly set with sufficient rake to allow of sustaining a strain of at least 900 pounds. To these poles should be attached, by means of eye bolts, a galvanized steel wire having a diameter of at least .204 of an inch, and drawn taut so that the poles will come to a perpendicular position. To these span wires there should be attached a suitable insulating device over the center of each track, with proper attachments for suspending the trolley wire. This insulating device should be small in its construction, consistent with strength and high insulation, and the insulating material formed in such manner that it will in itself constitute a protection against moisture. The trolley wire should, in my judgment, be at least $\frac{3}{8}$ of an inch in diameter, considering the objection that is raised to the multiplication of wires in the street. This wire should be hard drawn copper in lengths of at least one mile each. In this case the number of splices is reduced to a minimum, and by means of a suitable splicing ear the joints can be neatly, perfectly and securely made.

Where the streets are of a width of at least 60 feet from curb to curb, it is regarded as thoroughly safe and practicable, in cases of double-track roads, to place the poles in the center of the street between the tracks, and whether these poles be made of iron or of wood of octagonal shape, I consider that this arrangement presents the best form of overhead construction that can be secured.

When a conduit can be constructed that will permit of the safe, reliable and economical operation of street railways by means of electricity, we will all rejoice and be glad. If its first cost can be made sufficiently reasonable to permit of its use in cities of, say, 50,000 inhabitants it will be a magnificent achievement, and one that will surely bring its just reward to the successful inventor.

This thought is not prompted by reason of any vexatious troubles or annoyances which have occurred in the operation of the overhead system, but wholly on account of the objections which have been raised to the rapid multiplication of poles and wires in the streets, occasioned by the remarkable development and progress of the electrical science.

One of the prominent electrical companies is, and has been for some time, carrying on extensive and elaborate experiments with conduits, but have not, I believe, fully satisfied themselves of the commercial success of their latest undertaking.

I find little or no objection to overhead wires in places of less than 50,000 inhabitants. For this reason, and the fact of its low first cost, the overhead system will, no doubt, continue to be used in such places for some time to come, regardless of developments in the conduit system.

One of the most important features of an electric railway system is the track or roadbed. My experience has been that sufficient attention has not been given to that part of the equipment, especially until very recently. The track should be constructed of a good form of girder or "T" rail, weighing 54 or 40 pounds per yard respectively, and should be attached securely to suitable ties placed not more than $2\frac{1}{2}$ feet apart. It should be well ballasted, and where crossings are made over other tracks solid castings should be used in order to prevent the jolting and jarring which occurs when passing over them. The rails should be kept as clean as possible where they are used as a part of the return circuit. In order to use the rails of the track in completing the return circuit, they should be firmly connected together by a copper wire in addition to the ordinary fish plates, and in certain cases, depending wholly upon the length of the line, number and extent of grades, and number of cars and amount of traffic, there should be used a supplementary copper wire, the size of

which must depend upon the conditions just named. It is asserted by some electricians that the efficiency of the return circuit is increased in all cases by the use of a supplementary wire; but my experience has been that upon small roads where the grades and traffic are light, that satisfactory and economical operation is secured where the supplementary wire is omitted.

Some of the essential requisites of an electric motor car are proper controlling mechanism and reversing switch for controlling the speed and direction of the car, a lightning arrester and multiple fuse box. It should also be provided with suitable life-guards, gong-bells and headlights. The wheels of the car should in my judgment be at least 33 inches in diameter, and weigh 300 pounds each. This will give increased adhesion and allow the motors to be raised sufficiently high from the ground to practically prevent the possibility of its being injured by striking obstacles between the rails.

Increased speed with a very slight increase of power will result by the use of the 33 inch instead of the 30 inch wheel.

The possible speed of a car equipped electrically is measured only by the limit of safety. The regulation speed in the majority of places is twelve miles per hour, and the average mileage per car per day about 115. It is well known that upon well regulated steam railroads the locomotives rarely make a continuous run of over 100 miles per day; and considering the extraordinary care that is given to them, and remembering in the same connection the very slight degree of care given to the average electric street railway motor, I think the latter is entitled to a very handsome compliment for the good service it gives us; and when you know that the best average mileage that can be made by a car propelled by the Kentucky horse or Texas mule is 60 miles per day, and even in doing this it is necessary to make at least four changes per day, I think you will admit that the electric railway motor is doing most admirable service.

The smallest town in the United States which has an electric street railway in operation is Southington, Conn., with a population of 5,400. Two cars are in service over two miles of track, and the average daily receipts are $9.00 per car. The power for the operation of this road is furnished by the local lighting company and costs $1.25 per car per day. The largest electric railway is at Boston, Mass. This entire system comprises 284 miles of track, 60 of which are electrically equipped and there are 312 motor cars in operation. During the month of August they had 300 motor cars in service, making a total mileage of 384,700,000. The mileage of the tow cars was 59,948,000, making a total car mileage of 444,648,000. From August 10th to August 16th, 700,000 passengers were carried by these cars without a single delay. In the month of September, 312 motor cars were in operation, making a mileage of 343,466,000, and the mileage of tow cars 56,047,000, making a total car mileage of 399,513,000.

Average number of motor cars run per day, 20; average number of trail cars run per day, 0; average number of hours per car in service per day, 18; average number of miles per car, per day, 108; electromotive force, 500; average ampere readings taken hourly, 122; average electrical horse-power, 81.8; average electrical horse-power per car 4.9; number of passengers carried per day, 11,060; number of passengers carried per car, per day, 553; cost of operating, per car mile, $0.0616; receipts, per car mile, $0.2560; cost of operating per car, per day, $6.65; receipts per car, per day, $27.65.

Most flattering testimonials have been received from railway companies who have adopted the electric system and while they express their absolute satisfaction with the new motive power, they also state that the earning capacity of their road has been materially increased. In some cases the increase is given as high as 400 per cent., and in others as low as 50 per cent., but in no case that I can now remember, has the increase been given lower than the amount last stated.

Inquiry is sometimes made as to whether a motor car can be safely and reliably operated without a conductor. The present form of trolley and overhead construction readily permits of this; but I do not regard it as practicable or advisable, except in the smaller places where the business of the road will not justify the expense of a conductor. I am familiar, however, with a number of roads in towns or cities having a population of less than 30,000 where the car is in the exclusive charge of the motorneer, and no trouble is experienced in its operation. With a good track there is little, if any, possibility of accident when proper care is exercised in taking curves and switches. Where the business will warrant the expense, however, there should be a conductor with every car or train.

We cannot overlook the fact that there are still some complaints of excessive cost for repairs and maintenance of the electrical apparatus, but I insist that the responsibility for this condition does not rest altogether with its manufacturers. The managers of these electric roads must appreciate that they are exacting a greater mileage duty of their motors than is expected of the ordinary railroad steam engine and under conditions manifestly more unfavorable. If they will admit this, and see to it that their tracks are put in good order and so maintained, and the same degree of care and attention given to their motors that is given to the steam engine, I am satisfied they will have little to complain of. How rarely do you find an electric motor operated on a track like that prepared for the steam engine? And how seldom do you find a man in charge of the motor car who has the intelligence, training and experience of the steam engineer?

Several railway companies which adopted the cable system before the possibilities of the electric system were fully appreciated or understood, are now seriously considering the complete displacement of that system and the substitution of electricity in its stead. I was recently informed by the president of one of the electric railway companies, whose line is a competitor to a cable road, that the latter company, feeling keenly the effect of the competition of the electric system, had about concluded to reduce the fare on their road to four cents per passenger. Before this action takes place, however, I have no doubt that some bright representative of the electric system will persuade our cable friend to join the procession of progress, abandon the cable, welcome and adopt electricity as the motive power, and thus preserve the independence and stability of his street railway system.

There is no system or method of rapid street transportation that is so universally popular as the electric system; its wonderful flexibility is unparalleled in the history of street railways; capable of moving in either direction with equal facility, its value is materially enhanced from the standpoint of safety. Its first cost is about the same as for the animal system, and considerably less than the cable system. Knowing what the possibilities of the electric system are, and how cheaply it can be maintained and operated under proper conditions, I think we will see street railways thus equipped in many towns of a population not exceeding 10,000, and in some cases even less, and at a period not very remote.

I have previously alluded to the remarkable growth of the electric railway business, and given some reasons for it, but I do not feel that full justice has been done to the pioneers—I mean the manufacturers of the apparatus. When you consider what they had to do and what they did do to inspire confidence in the undertaking, I think you will all agree with me that they have merited even greater success than has attended their efforts, if that be possible. Contracts with all sorts of guarantees were made, long trial periods were given, the cost of maintenance guaranteed to be less than for the same number of cars operated by animal power, the current guaranteed not to be fatal to human life, and the system warranted to work in a thoroughly practical and successful manner, with a general and sweeping provision that in case of failure in any of the guarantees that the railway company could, at their option, throw the apparatus out and assess the electrical company any damages which they had sustained by reason of the alleged experiment. Was there ever a new industry vouched for so absolutely by its projectors? Had the electric companies been less liberal with their guarantees, and not exhibited such a marked degree of confidence themselves, we undoubtedly would have been able to-day to count the number of electric railways by tens instead of hundreds, for it is but a short time since the financial world has given its unqualified indorsement to the system. Bankers and trust companies took no part in formulating public sentiment or confidence in this matter. The undivided burden was assumed and borne by the electrical company, and not until they had fulfilled their numerous guarantees faithfully and well, and demonstrated beyond all peradventure the full and complete success of the electric street railway, was the moneyed man or corporation willing to assume any hazard or risk. How the conditions have changed in two short years! Every principal city in the United States now has its electric street railway; full confidence has been established, and unreasonable guarantees are no longer required.

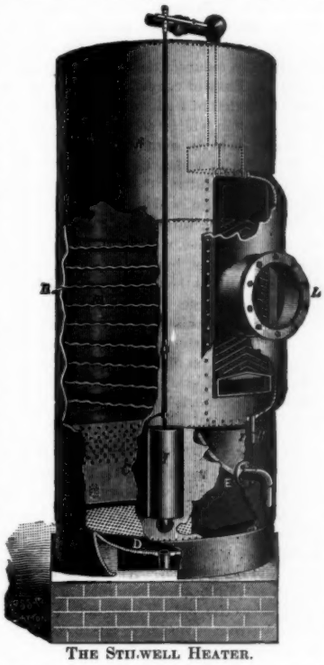
In closing, permit me to offer this prediction, that within a few years surface and elevated railways, operated by animal, cable and steam power, will be numbered with the events of the past, and electricity, with all its beautiful attributes, in all its grandeur and magnificence, and in the full measure of the wide range of its possibility will claim supremacy in the broad realm of street railway transportation.

—— The Thomson-Houston Electric Light Company, of Kingston, N. Y., has purchased three-fourths of the capital stock of the Kingston and Rondout Gas Light Company. The transfer of the stock to the former company will practically be a consolidation.

Stilwell's Improved Heater and Filter Combined.

In those days of sharp competition no steam power plant using high pressure engines can be regarded as complete, from an economical point of view, unless it is provided with an efficient heater utilizing the exhaust steam for heating the feed water for the boilers, and if at the same time the heater can be made to thoroughly purify the water so as to prevent the formation of scale in the boilers, its economical value is thereby greatly augmented.

In the Stilwell patent improved heater, herewith illustrated, patented in April last,



THE STILWELL HEATER.

its manufacturers claim to offer just such a device, and they further claim to have successfully met all the objections hitherto urged against open heaters. Briefly stated, the following advantages are claimed:

1. Very large heating and filtering capacity, and also depositing surfaces for receiving the deposits of lime and other impurities.
2. Increased facilities for quickly and thoroughly cleaning the heater.
3. Effectual devices for separating and catching the cylinder oil contained in the exhaust steam.
4. Automatic regulation of the inflow of cold water, thus insuring an even and steady feed.

A finely illustrated descriptive catalogue can be had upon application to the manufacturers, Stilwell & Bierce Manufacturing Company, Dayton, Ohio, who for more than a quarter of a century have made a specialty of machinery for heating and purifying feed water for steam boilers, a fact which entitles their claim to careful consideration.

—— Messrs. Thurston & Company, proprietors of the Providence Electrical Supply Company, Providence, R. I., has just finished the wiring of the Pilgrim Church in that city for upward of 100 sixteen candle-power incandescent lights. The firm has been highly complimented for the creditable work it has performed. The same firm has been awarded the contract for wiring the Jones Building, in city named, for 400 incandescent lights.

—— H. H. Shufeldt & Company have for some years past been using electric lights at their distillery, 23 Larabee street, Chicago, having for the purpose a dynamo capable of supplying about 125 lights. Finding that additional lights could be used to good advantage, they recently asked for bids on a much larger plant, and after very severe competition the order was placed with the Western Isolated Lighting Department of the Thomson-Houston Electric Company for a 400 light incandescent plant. The dynamo previously used will be discarded and an entirely new plant will be installed.

—— Leading business men of Chicago do not favorably regard the unanimous proposition of the city council that the municipality own and operate the gas and electric lighting plants. Marshall Field thinks it would be very unwise, unless the city has a very much better government than it now possesses. Franklin MacVeagh is "dead opposed to the municipality extending its enterprises so long as the present spoils system prevails." This is also the view of Lyman J. Gage, who fears that the losses from the corrupt management of ward politicians would offset any advantages to be gained.

ELECTRIC LIGHT NEWS

—— It is said that the Lighthouse Board has decided to equip several light-ships with electric lights.

—— The C. H. & D. Railroad has ordered 12 electric head-lights, which will be placed on through trains.

—— Queen Victoria has announced that she is decidedly averse to having the electric light introduced into Windsor Castle.

—— The Gas, Electric Light and Power Company, of Muscatine, Ill., has increased its capital stock from $100,000 to $120,000.

—— Since the introduction of electric lighting into large manufacturing establishments the record shows a marked improvement in the health of employés.

—— The Amesbury Electric Light Company, of Amesbury, Mass., will install an additional 750-light alternating current dynamo of the Westinghouse type.

—— The South Denver, Col., Electric Light Company has purchased land upon which an electric light plant will be erected to furnish the residents of South Denver with electric lights.

—— At a special election held recently it was voted to bond the village of East Tawas, Mich., for $10,000 for an electric plant to light the village streets and for commercial purposes.

—— The Western Isolated Lighting Department of the Thomson-Houston Electric Company has closed a contract with the Atlantic Mining Company, of Houghton, Mich., for a nine light arc plant.

—— The Allegheny, Pa., committee on gas has abolished the office of superintendent of gas with a salary of $1,200, and created the office of superintendent of public lighting with a salary of $2,500.

—— Mr. H. E. Chubbuck, secretary and treasurer of the local electric light company at Springfield, O., has accepted the position of secretary, director and treasurer of the Omaha Thomson-Houston Electric Light Company.

—— The general offices of the Westinghouse Electric and Manufacturing Company have been removed from the Westinghouse Building, Penn avenue and Ninth street, to the manufacturing plant on Garrison alley and Duquesne way, Pittsburgh.

—— The electric light company at Amesbury, Mass., has just put in a new 200 horse-power engine, which will more than double their present motive power. A new incandescent machine of 500 lights will also be put in. The electric cars of the Newburyport and Amesbury Railroad are now supplied with power, as well as several factories in the vicinity.

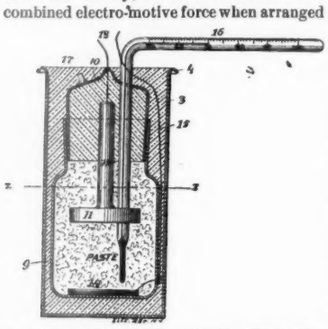
—— The Grand Junction, Colorado, Electric Light Company, who were very recently granted an extensive franchise by the city, have purchased from the town ten lots, upon which they will at once commence the erection of a power house, and make other improvements necessary for the completion of their plant. The company proposes to erect a power house with all necessary machinery to furnish an electric system for Grand Junction, second to none in the State.

—— A number of prominent New Orleans merchants have formed a co-operative association to erect, for their own use and at their own expense, an electric plant to light up their stores with electric arc lamps. These merchants are before the common council with a petition asking for the privilege of stretching their wires along the poles now in use by the Louisiana Electric Light Company, after paying a fair compensation to that company, which originally erected the poles.

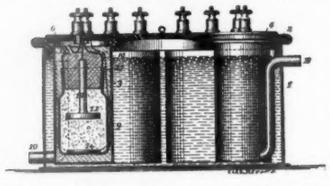
PROGRESSIVE ELECTRICAL INVENTIONS.

STANDARD TESTING BATTERY.

We illustrate herewith an improvement in standard batteries invented by Edward Weston, which is designed to yield a constant electro-motive force of 10 legal volts for purposes of electrical measurement. The active materials of the battery are the same as in the Clark standard cell, namely, zinc, platinum, and a paste of mercurous and zinc sulphates. A group of seven cells constitutes the battery, in order to make their combined electro-motive force when arranged



in series an even number of volts. The cells, as illustrated in the engraving, are arranged in a circular series within a containing vessel marked 1, and are so arranged that any one of the cells may be withdrawn. Pipes 18, 19 enter the enclosing vessel 1, so that water of a proper temperature to maintain the cells at a temperature of 67½ degrees Fahrenheit may be introduced. The zinc electrode 11 is in the form of a disk, having a central standard 12 to which is secured a terminal wire 13 passing through a projection of the bell 10 into which it is sealed. The negative electrode 14 is a corrugated disk of platinum containing numerous small perforations. The terminal wire for this electrode passes through the side of the glass jar 9, wherein it is sealed, and then upwardly to a binding-post. The electrolyte is a solution of pure mercurous sulphate mixed with a solution



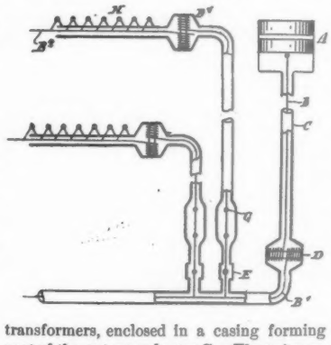
of zinc sulphate to form a paste. Into one of the cells is introduced a thermometer 16, passing through the glass bell cover 10 and sealed therein. The bell-shaped stopper is filled with a mixture of beeswax and gutta-percha, which holds the zinc electrode firmly in position. After the parts have been assembled and inserted in the containing vessel 3, of which there is one for each cell, melted paraffine is poured around the cell proper so as to completely fill the space between it and the containing vessel 3. These cells are then grouped in the outer vessel 1 and connected in series; they are then ready for service. The circular arrangement of the cells permits of the convenient use of one or more of them, as may be desired.

SECONDARY BATTERY.

A patent has been issued to Friedrich Marx, of Berlin, for a secondary battery, in which the usual lead electrodes are replaced by iron and carbon, respectively, and the ordinary solution is replaced by an aqueous solution of equivalent quantities of protochloride of iron and muriatic acid. The solution is formed by dissolving about 450 grams of the protochloride of iron in 500 grams of 25 per per cent. muriatic acid and 900 grams of water. An electrode of iron and one of carbon are inserted in the solution, and connected in circuit with the charging source, such as a dynamo-electric machine, the iron being the cathode. On the passage of the current the formation of what the inventor calls "electrolin" takes place without deposition of metal, the termination of the process of charging being ascertained by a peculiar change in the color of the solution, which turns brown, while at the same time the cell gets warm. The iron electrodes are then lifted out of the cell and the "electrolin" so formed is ready for use at any time by returning the iron electrodes and closing the discharge circuit. The "electrolin" may be charged in one vessel and then withdrawn and used in a cell at some distant point. The inventor describes one form of iron electrode which may be allowed to remain in the solution after the charging process has been completed. It is formed by combining iron filings with carbon and a binder such as coal-tar, after which the mass is coated with tar, dusted over with finely divided carbon, and baked. By making the electrodes of the material specified the weight of the cells is very largely reduced, the specific gravity of carbon and iron, of course, being very much lower than that of lead, and by causing the transformation which renders the cell active to take place in the solution itself instead of in the material which constitutes the electrode, the difficulties of disintegration after prolonged service which appertain to the ordinary storage battery are obviated. Dr. Marx is, of course, not the first inventor to produce a storage battery in which lead is dispensed with as the material of which the electrodes are made. It is interesting to note the batteries of this type, as it is more than possible that the storage battery of the future will be planned on different lines from those now in use, and every departure containing a bud of promise is worth careful examination.

LONG DISTANCE TRANSMISSION OF POWER.

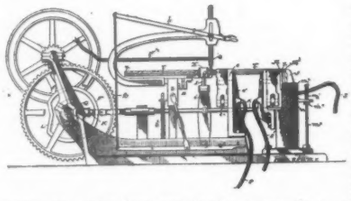
In a patent issued to Dr. De Ferranti, the well-known pioneer of alternating current distribution, is described a system for supplying towns or other places with electrical energy at a considerable distance from the source of generation. At the generating station is employed an alternating current dynamo-electric machine wound to give a high electro-motive force, say 10,000 volts. From this generating station, marked A in the accompanying illustration, mains are led to stations in the towns where the current is to be used. Transformers situated at these stations reduce the current to a practical limit for distribution in the town, and mains carry this reduced current to the different houses or blocks of houses which are to be supplied with current. Other transformers placed at these houses reduce the current to a still lower tension. For example, the high electro-motive force enables the current to traverse the line wire connecting the generating dynamo with a station on the outskirts of a town, where, in its passage through the first transformer, marked D in the accompanying diagram, the tension is reduced to, say, 2,500 volts. This current then passes to the sub-stations in the town, where, by means of another transformer, it is reduced to, say, 50 volts, and this voltage, being comparatively free from danger, is used in the consumption circuit to feed lamps or other translating devices. In carrying the current, concentric conductors are used, as illustrated in the engraving by B C. D is one of the



transformers, enclosed in a casing forming part of the outer conductor C. The primary of this transformer is connected at one end to the inner high tension conductor B, and at the other end to the casing. The secondary is connected at one end to the casing and the other end to a tertiary conductor B^1, which includes the primary of the second transformer D^1, the other end of this primary being connected to the conductor C, as illustrated. The secondary of transformer D^1 again is connected at one terminal with the conductor C, and the other terminal with the lamps grouped in multiple arc between the two conductors, as seen at B^2. At E is represented a switch, and at G a safety fuse, located in the circuit supplying the several houses or streets, and insuring safety in case of accident with the first transformer.

MAKING METALLIC WHEELS BY ELECTRICITY.

A patent has been granted to W. P. & J. W. Bettendorf, of Davenport, Iowa, for an improvement in the manufacture of metallic wheels, by which the spokes are welded to the hub and tires by means of an electric current passed through the parts during the welding operation. In the accompanying engraving is illustrated a side elevation of the machine used for carrying out the invention, X representing the iron hub, Y the spokes and Z the tire of a wheel. Each spoke just prior to the welding operation is clamped by means of two pairs of jaws C^1 H^1, and a bar Q, connected with one side of the heating circuit, is brought down upon the hub. The current passing through P^1 Q and out by conductor P, heats the metal to a welding temperature, when a heading tool I is forced up against the end of the spoke to upset it and establish the weld. A similar operation is performed on the end of the spoke entering the tire, by means of the heading tool J, and a current passing through the tire and the outer end of the spoke by conductors S S^1. The parts are so arranged that by pressure on a foot lever b^3, the wheel can be drawn down by means of its support B, into operative relation to the clamps, thus permitting a rapid change to the next spoke after a weld has been completed, by simply removing the foot from the treadle and turning the wheel a sufficient distance on its support after it is lifted clear of the clamping jaws by the



spring b^2. The foot lever is also arranged to depress the contact bar Q, and close the circuit simultaneously with the lowering of the wheel into operative relation to the clamping jaws. A movement of the gear wheels causes a cam F^1 to shift a bar operating the clamps, and simultaneously another cam L shifts a bar K and throws the heading or upsetting tools into action. By the action of the machine, the spoke is upset and enlarged both inside and outside of the hub and the tire.

IMPROVEMENT IN ELECTRICAL MEASURING INSTRUMENTS.

Edward Weston, of Newark, N. J., has recently patented a dead-beat mechanism for electrical measuring instruments, the improvement consisting in opposing the movement of the indicating needle by friction, and after the circuit is closed, gradually reducing the amount of friction and permitting the needle to slowly proceed to its indicating point, where it will stop and remain still during the continuance of the current. The frictional device used is a soft leather pad held by spring pressure against a smoothly polished disk mounted on the needle axis. A push button is used to close the circuit, one terminal of which is a leaf spring carrying an arm on which is mounted the leather pad. When the push button is depressed, the circuit is first closed, then pressure of the pad is reduced, until, when the push button has reached its limit of depression, the pad is entirely free of the friction disk.

—— The Schuyler Electric Company is compelled to build a new factory at Middletown, Conn., so great is the demand for its very popular electric lighting apparatus. Ground has already been broken and the work is being pushed rapidly ahead.

A Novel Indicator.

In the annexed cuts is illustrated a novel indicator, made by Gent & Company, of Leicester, England. It is contained within a walnut case, with black glass front, having the names of rooms upon it in distinct letters; there is a diamond-shaped opening opposite each name of room, and behind the glass a white pointer revolves and stops opposite the named opening corresponding with the room in which the button is pressed; the pointer then remains in sight until the button in another room is pressed, when it instantly passes opposite the opening corresponding with the room in which the button was last pressed.

If required, it may be provided with a stud (as shown at the bottom of engraving), in pressing which, the pointer will pass out

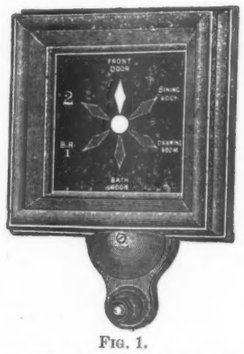


FIG. 1.

of sight. The bell is fixed in the same case.

It is fixed and the wires run exactly as other indicators, no special directions being necessary.

It is specially clear in indicating the rooms, as there can never be two in sight on the same circle at the same time. The action is as follows (Fig. 2):

The revolving pointer is actuated by an electro-magnet vibrator operating upon a milled wheel; the spindle which carries the pointer also carries a cam and an insulated ring; as many springs are provided as there are divisions on the disl, each division representing a room to be indicated; each of the springs rests on the edge of the revolving cam. The cam is connected through the spindle with the vibrator, so that when a current is sent along any one of the springs, it can pass along the cam to the vibrator, causing the spindle to revolve. The cam is provided with a notch, into which each spring faces in succession as the spindle revolves. The insulating ring which is fixed close to the cam, and moves with it, is connected with the electric bell, and the springs as they fall into the notch fall upon and make contact with the insulated ring. On reference to Fig. 2, suppose the current enters at the left hand or No. 1 binding screw, it passes over No. 1 spring, through the cam and spindle to the electro-magnetic vibrator, and on to the end or right-hand binding screw, and then back to the battery. The vibrator being thus set in motion, the spindle rotates carrying the cam round until No. 1 spring drops into the notch, when the current is shunted from the cam and vibrator to the insulated ring, so setting the electric bell

FIG. 2.

in motion—the bell ringing as long as the button is pressed in and the current maintained. It will be seen that No. 1 spring will remain out of contact with the vibrator until a current is sent through one of the other springs, causing the cam to rotate, when No. 1 spring will again be lifted into contact with the cam, ready for use. The indicator, as sketched above, has the pointer always in sight opposite the opening last used. A press button is arranged, as shown in Fig. 1, which causes the pointer to always stop at a space between the openings, and so out of sight. The indicators are usually constructed for any number up to 10 signals on one board; if more than 10 signals are required, two smaller dials are recommended. We are indebted to *English Mechanic and World of Science* for this description.

The Mechanics' Fair at Boston.

One of the time-honored institutions of Boston is the Massachusetts Charitable Mechanics' Association, which is generally known to the public through the mechanics' exhibition which it holds every three years; but this organization has other and in many respects more important functions than the holding of this exhibition. It was founded in the year 1806 solely as a benevolent institution, being composed of mechanics, and, for the purpose of an organized charity towards its members or their apprentices who might be in want; and to this day, with its immensely larger resources its true work is still in the line of charity, although much of it is in that true charity which consists of affording opportunities for the exploitation and introduction of inventions by means of these exhibitions.

In 1881, this Association built a new hall costing $500,000 for the purpose of holding its exhibitions and also for such other uses as might be required of a building of immense size. This building is situated on Huntington avenue, Boston, and is a massive brick structure ornamented with stone and terracotta, portions of the building rising to a great height. It extends for 600 feet on Huntington avenue, with a greatest width of 345 feet, the whole covering a ground area of 110,000 square feet. This is divided into three sections, the first being the administration building, the second the exhibition hall, and the third is known as the grand hall, being provided with an organ, and seating capacity for 8,000 people. The whole of the building is occupied for this immense exhibition, and at other times portions of the building are used for various purposes.

At these exhibitions merit is suitably recognized by the awards of diplomas and various medals at the hands of groups of judges, who are selected with great care as specialists in the department submitted to their charge. The recommendations are based upon the following classifications for awards:

1st. Very valuable inventions and discoveries.

2d. Articles of superior and artistic workmanship. New and useful applications of material. Manifest improvement in construction of articles or machines of an important class.

3d. Articles of superior workmanship, but of less importance or value to the community; and the coarsest grades of articles which show originality and are of marked benefit to the public, and when the same are constructed in the best manner.

4th. All other exhibits deserving favorable mention for their beauty of design, or convenience in form or construction, and therefore entitled to the approbation of the Association.

The exhibits in electrical apparatus would be of special interest to our readers. These are in charge of Mr. E. Noyes Whitcomb, the judges being Prof. A. E. Dolbear, of Tuft's College; C. J. H. Woodbury, of the Boston Manufacturers' Mutual Fire Insurance Company; F. Elliot Cabot, electrical inspector of the Boston Fire Underwriters' Union; Capt. B. S. Flanders, superintendent Boston Fire Alarm, and Frederick Lane, of Lane & Small, manufacturing electricians. Mr. A. L. Russell was appointed as one of the judges, but as he desired to enter as an exhibitor, this disqualified him and he declined to serve.

The lighting of the exhibits is certainly one of the most important functions of electricity, and that is done by the Mather Electric Company, who have a very complete electric lighting station in the basement supplying incandescent lamps over the whole of this large building. At another place, however, in the exhibition hall is an exhibit of the various lamps, motors, switches and other electrical attachments, shown by Messrs. Claflin and Kimball, the Boston agents of the company. These switches especially are of excellent construction, and there are also some novelties in connection with the motors, particularly in the method of reversing motors by means of a reversing switch in connection with the rheostat used in starting the motors.

The Thomson-Houston Company exhibit some of their arc lighting dynamos, which furnish arc lights in various parts of the building and also a large number of incandescent lights in the basement. These dynamos are driven by the Evans friction ring, a pair of dynamos being placed so that their pulleys are almost in contact with the driving wheel of the engine, the space between the two being filled with a number of leather rings, forming what is known as the Evans method of driving. The friction of the loose rings, adhering both to the driver and the driven pulleys only through the lines of contact, serve to transmit the power very successfully. There are a number of electric motors of this company in various parts of the exhibition, all of them busily at work driving various machines, or, as is the case of the exhibit of farming and harvesting machinery, keeping them in operation in order that their motions can be clearly seen.

The Whittier Machine Company exhibit elevator machinery operated by Thomson-Houston motors, In one instance, a motor of the street railway type is directly applied to the hoisting mechanism of the elevator, the motor being operated by an attachment to the hand rope in the elevator in the same methods, as far as manipulation of the operator is concerned, as those used in the case of elevators directly driven by steam engines. The other elevator mechanism is of the hydraulic type, in which the motor drives a pump forcing the water into a reservoir.

The "C. & C." Electric Motor Company have an exhibit of their electric motors and appliances, whose work is very clearly demonstrated, as the motors are used to operate rotary pumps producing fountains at the tank adjoining this exhibit. One form of great convenience in the operation of these motors is the combining of the double pole switch and rheostat in the starting box, so that one action will manipulate the operation of the motor as may be desired.

The Belknap Motor Company has an exhibit of their water motors running various kinds of small machinery, particularly several dynamos.

The exhibit of the Interior Conduit and Insulation Company is alike instructive and brilliant, as they show a complete installation of electric wires in their tubes with a large number of ornamental lamps in circuit. The representative in charge of the exhibit is kept busily at work showing to interested parties the method of placing wires in the installation and then removing them.

Much interest is manifested in the new form of brushes for dynamos and motors made by P. C. Holmes Company, of Gardiner, Me. These brushes are made of a mixture of chemical wood pulp and graphite beaten together in a pulp engine and then subjected to a great pressure in porous moulds, allowing all the water to escape. They are then subjected to heat sufficient to carbonize the wood and covered with copper by electroplating. It is stated that these brushes have been in practial use for several months, but it is evident that if their conductivity is all that can be desired, the smooth and lubricating character of the graphite which they contain will tend to lubricate and preserve the commutator bars instead of abrading, when subjected to the severe wear which this portion of electric light machinery is called upon to sustain.

A. L. Russell presents an exhibit of electrical apparatus and appliances of types which are certainly well known in the general market, with the possible exception of a very delicate and improved galvanometer.

Adjoining this is the exhibit of the Holtzer-Cabot Electric Company, containing a large variety of electric light connections, watchman's time detector, electric clock with the Spellier attachment for setting the various clocks whose dials are operated by the master clock in the exhibit. In the basement this same firm exhibit a number of Eddy electric motors.

A large amount of fine copper wire of excellent finish, some of which is covered with different varieties of silk and of cotton insulation, especially for electro-magnets, is exhibited by B. S. Hale & Son, who, it seems, has received awards at previous exhibitions.

One of the most interesting exhibits is that of the New England Printing Telegraph Company, consisting of what is known as the Essick telegraph system. The sender is operated by a keyboard similar to that of a typewriter, and both the message at the other end and the duplicate in front of the operator is printed in typewriter. This is in operation on a line running from the Fair to the office of the company, in another portion of the city, about two miles away. One of the special services which it is expected this form of telegraphing will be put to is that of reporting current news, either for various newspaper offices or for financial purposes, including the distribution of financial news and reports of sales of stocks in brokers' board. A single transmitting instrument will print in duplicate at any number of receiving instruments.

The American Fire Alarm System exhibit one of their installations. This is of the type known as the open circuit system, the thermostats being in multiple on the various branches. These thermostats consist of a simple Bourdon spring, filled with some vapor which volatizes at a comparatively low temperature, and yet will not freeze. The thermostats are made to operate at various temperatures, as may be desired, ranging from 130 to 180 degrees. The rise of pressure above the pre-determined point straightens out the Bourdon spring and closes an electric circuit, ringing an alarm on an annunciator wherever it may be placed. A testing device will test out the circuits once an hour, and record the results on a card revolving once in 12 hours, like the well known watchman's time detectors. This is a particularly simple type of alarm, and has been very extensively introduced for isolated buildings, the alarm apparatus being at the fire engine house or elsewhere.

The electric safety engine stop consists of an apparatus by which push buttons in any part of the establishment will close a circuit energizing an electro-magnet, whose armature is attached to compound levers which release a hanging weight, and this, in turn, can be used either to open a clutch or to actuate mechanism which will stop an engine, either by means of a quick motion valve or by means of a device that will engage with the governor in such a way as to prevent the engine from receiving steam.

The safety device for trolley wires by Robert A. Morgan is one of the first of what will probably be a large number of inventions brought into being by the prominence of this method of operating street cars. In this device the trolley wire is supposed to be hooked together at every section in such a way that in case the wire is broken in any way both ends of it will at once be released and it will drop to the street a dead wire. The small portions of the model shown do not afford one the same opportunity of passing judgment as would be obtained by an examination of the apparatus in actual service, for it is only by the practical tests that merits of such a device can be entirely established.

The American Magneto Electric Company exhibit a number of very ingenious applications of the magneto for purposes for which batteries are frequently used, especially in ringing bells in annunciators and in house service use. The peculiarity of the device here is that the magneto which furnishes the current consists of a Siemens armature revolving within a four-pole magnet, and instead of the alternating current usually applied, the coils in the armature usually receive two electrical impulses in one direction and then two in the other. This sequence of currents gives accumulated action which is much more powerful than in the ordinary type of alternating current magnetos. The strikers to bells and drops to annunciators, etc., are connected to the Siemens armature, which oscillates between the poles of a magnet, and the method of applying the current is sufficiently powerful so that bells of about a foot in diameter are forcibly rung.

There are two of the mechanical telephones on exhibition; one of the Pulsion telephone, which has a large circuit in the neighborhood and can be used by persons at the Fair. The other is what is known as the glass telephone, in which the peculiarity is that the case is made of glass, with the object of giving a greater resonance to the vibrations.

The last exhibit in the electrical line is one in which it would not be expected that electricity would be applied, but such application is made, and apparently very successfully. It is the electric incubator of L. E. Ross, in which the incubator is heated by a kerosene lamp, with peculiar measures taken for keeping the air to a proper moisture. The temperature is controlled by a thermostat made of a compound bar of hard rubber and steel, and whose operation actuates a slight register which permits the escape of the heat if the temperature rises above a predetermined point, and the opening of the incubator causes the apparatus to work very promptly. It is surrounded by a large crowd of people examining with great interest the hatching of chicks from among the large number of eggs there, while, perhaps, some of the older ones may recall the old saying of the Inquiries of the Ignoramous to the Philosopher: "Tell me, oh, wise man, I do beg, which came the first, the hen or the egg?"

First Philosopher: "First came the egg or whence the hen?"

Second Philosopher: "First came the hen or whence the egg?"

Conduits in Cincinnati.

The Queen City Electric Company has petitioned the Probate Court for authority to lay conduits under the streets for the purpose of carrying electrical wires through them. The company avers that its business has extended to such a degree that it is no longer possible to meet the demands upon it except by the underground system.

The Edison General Electric Company has filed a motion in the Common Pleas Court for a dismissal of the appeal of the city from the judgment of the Probate Court giving the company the right to lay conduits under the streets and alleys of the city. It is claimed that the appeal cannot be entertained, for the reason that it was not filed within the time prescribed by law, which is six months.

DISCOVERIES OF THE PROVINCIAL PRESS.

What Dan Did in the Bowl Factory.

Dan. G. Williams, son of G. G. Williams, is certainly an ingenious young man of rare mechanical ability. He has constructed an entire electric light machine with a capacity of nearly 1,000 candle-power in his father's bowl factory in this village. He is using four lights, three 16 candle-power and one 50 candle-power, and they work very nicely. The dynamo made by Dan. will furnish electricity for eight large lights. There are very few men of experience who could make one of these electric machines and work it successfully. These lights were used for the first time on Wednesday night. —*West Branch, Mich., Times.*

He Appreciates Luxuries.

One of the new hands was bragging about the improvements of the G. P. depot yesterday evening to a colored rusticus. He said: "Us is gittin' onter all de new conventions down here. We's gwine ter hab dese yer indecent 'lectric lights put in our offis. You country niggers doan no whut lugshurioserty is."—*Anniston, Ala., Blast.*

A Cry From Philadelphia.

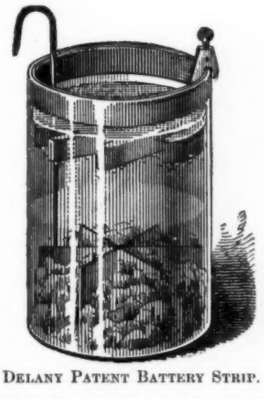
"Give us rapid transit, but don't give us the overhead wire system of running electric motor cars. What is needed is elevated railroads."—*Philadelphia Call.*

Rapid transit? Shades of Mercury! Rapid transit in Philadelphia? Impossible! But then, it is more than could reasonably be expected to think for an instant that any Philadelphian could grasp the idea of rapid transit and appreciate the advantages of electric traction all in one week. Next week the *Call* will want electric railroads.

The Delany Patent Battery Strip.

The bugbear of liquid batteries has always been creeping salts. Much valuable property has been ruined by the insidious advance of the crystals up the glass jar, over the side, down the jar and along the shelf on which the battery rested. A number of devices have been invented for the prevention of this fault.

Mr. Patrick B. Delany, of South Orange, N. J., and of telegraph fame, has come to the rescue with the invention illustrated



DELANY PATENT BATTERY STRIP.

herewith. It is so simple as to scarcely need description. The device consists of a strip of rubber cloth attached to the inside of the mouth of the battery jar by a waterproof compound. It offers a mechanical obstruction to the creeping salts which collect beneath the strip, and are re-dissolved in the battery fluid as water is added to the solution to repair the loss from evaporation. It is claimed that local action, causing waste and exhaustion of the battery, is prevented. A year's test of the device was made before putting it on the market. At the end of that time the cells tested were as clean on the outside as when first set up. The strip is applicable to gravity and all other forms of liquid batteries. It is easily applied, cheap in price, and after the test mentioned above, and with Mr. Delany's name attached to it, we have no doubt of its being able to accomplish all that is claimed for it.

ELECTRIC CLUBS.

New York Electric Club.

The Number of members who frequent the Club house is gradually increasing. Electrical men from a distance have learned that the home-like accommodations here are far superior to hotel life; so many of them make the Club their headquarters while in town. Electrical bachelors are all in love with the Club. Thursday evening always finds an exceptionally large number of members present, that being "Club night."

All Nationalities are represented in visitors to the Club. In one week, recently, there were present a Persian, a Russian, a German, an Englishman, a Frenchman and several Brooklynites, besides the American contingent.

The Cuisine is still maintained at its high standard of excellence.

Some Well Known names are understood to be on the list of lecturers for the season of 1890–91. A large attendance is expected for Prof. Nichols' lecture, which heads the programme,

Recent out-of-town visitors were: Louis Cohn, Chicago; Joseph Lewis, London; F. D. Tuttle, Brooklyn; P. B. Shaw, Williamsport, Pa.; G. D. Masten, Plainville, Conn.; E. H. Bouton, Richmond Hill, Conn.; J. Hart Robertson, Bloomfield, N. J.; a Persian gentleman with fringe on his name; H. T. Paiste, Philadelphia; and W. B. Cleveland, Cleveland, Ohio.

A Table d'Hote Dinner (costing $1.00) will be served from 6 to 8 P. M. on the occasion of Prof. Nichols' lecture. Tables will be set in the downstairs café. Members who expect to dine at the Club, should notify the Club a day in advance.

Several New Members were elected at the last meeting of the managers.

Boston Electric Club.

The Nominating Committee has reported the following officers and directors of the Club for 1891: President, Captain Eugene Griffin; Vice-Presidents, C. L. Edgar, C. J. H. Woodbury; Secretary, R. F. Ross; Treasurer, F. J. Boynton; Historian, Geo. W. Mansfield; Directors: To serve one year, J. Edward Addicks, Geo. E. Hanson, Jno. C. Wilson, William Brophy, Chas. Burleigh; to serve two years, A. L. Rohrer, H. B. Cram, R. F. Ross, L. S. Dumoulin, Geo. B. Neal; to serve three years, F. J. Boynton, F. H. Monks, Geo. W. Adams, Wm. C. Woodward, Wm. J. Denver; to serve four years, Frank Ridlon, E. H. Hewins, J. R. Lovejoy, W. D. Warner, C. W. Holtzer.

Buffalo Electrical Society.

This Flourishing Organization has begun the Winter season with a firm determination to derive the greatest possible benefit from a well planned series of lectures. The dates of meetings and the subjects are as follows:

November 17th, "Conception, Development and Future of the Storage Battery," William H. McDonald; December 1st, "Electro Therapeutics," Dr. Roswell Park; December 15th, "Advance of Electric Traction," Frank Kitton; January 5th, "Phenomena of Earth Currents," William Finn; January 19th, "The Chemistry of Electrolysis," William H. Dopp; February 2d, "Informal Talk on Telegraphic Subjects," A. C. Terry; February 16th, "Electricity in the Household," F. P. Jones; March 2d, "Effects of Electric Light on the Eye," Dr. Lucien Howe; March 16th, "The Telephone," M. Beecher Marvin; April 2d, "Present Status of the Transmission of Electrical Energy by Water Power," Madison Buell; April 16th, "Arc and Incandescent Electric Lighting," J. P. Chapin; May 6th, "On the Efficiency of the Alternating Current Motors," Edward F. Wilson; May 20th, "Electrical Measurement," Cuyler C. Smith; June 3d, "Observations on the Effects of Static and Dynamic Induction," Astley C. Terry.

The Society has issued a neatly printed leaflet giving the programme of lectures for the season of 1890-91 and the names of the officers of the society. Meetings are held on the first and third Monday evenings of each month.

Electrical Exhibit in Baltimore.

The Masonic fraternity of Baltimore, Md., has just concluded a very successful "Bazaar" in the Masonic Temple of that city. The object of this entertainment was to raise funds which are to be used in the interests of the Baltimore Masons. The Temple had been very gayly decorated. A fine orchestra of musicians had been hired to entertain the guests during the evening, and in addition the management of the Brush Electric Company of Baltimore had been prevailed upon to make an electrical exhibition in the hall to attract the people. These attractions, of course, were necessary to draw the crowd to the booths where an opportunity was afforded the friends of the Masonic Order to spend their money for the good of the Order.

The electrical display, however, had been announced as the big drawing card, and it redounds very greatly to the credit of the Brush Company that it turned out to be such a success. The accompanying cut is a very faithful illustration of the display, representing a number of those features which are characteristic of the Westinghouse alternating current system, under which the Baltimore company operates. Besides the 17 arc lights and about 200 incandescent lamps which the Brush Company burned in the hall, the exhibit consisted of a stage regulator, the Shallenberger alternating current meter and its method of working; then the cigar lighter, which attracted especial attention; on the table in the front two coils, illustrating the converter system. The two lamps on the top of the rails are 250 candle-power lamps. Down in the corner there are several small batteries and an induction coil. From this the attendant at the exhibit gave the visitors who desired it, shocks, and thus a good deal of amusement was afforded to the guests. The lettering, the compass, the keystone and other Masonic emblems were represented by incandescent globes of various colors, and the whole exhibit was very beautiful, indeed. Over 50,000 people have been to see the electrical display, it having been the first of its kind ever seen in Baltimore.

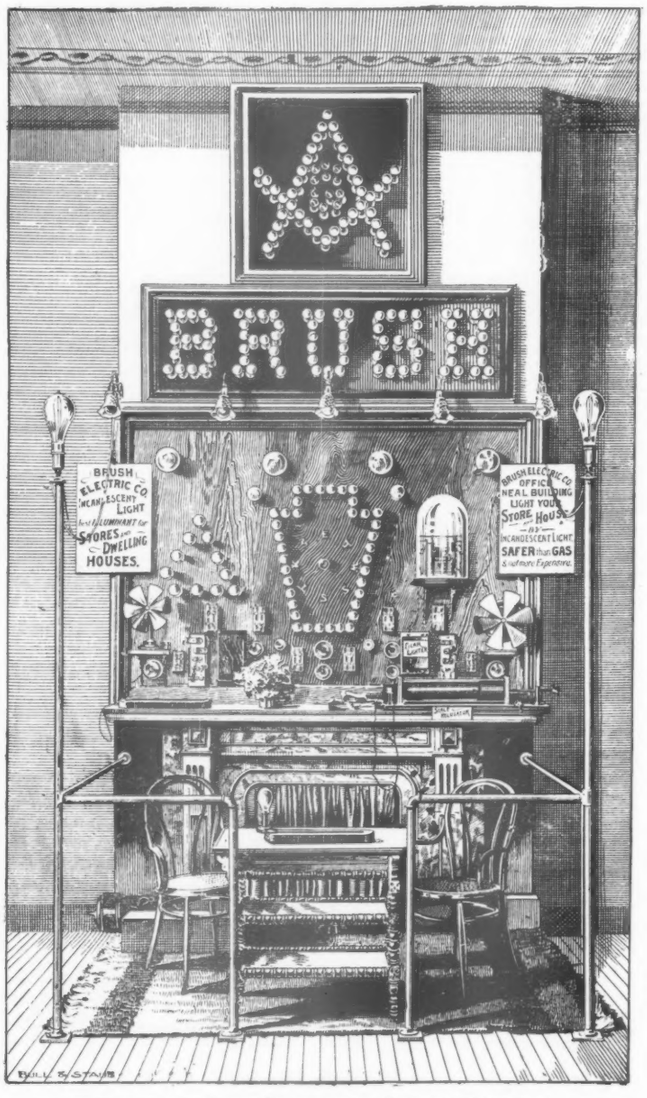


EXHIBIT OF THE BRUSH ILLUMINATING COMPANY, BALTIMORE.

Since the reorganization of the Brush Company, in Baltimore, the management has instituted some great improvements in the plant and a good many more are contemplated. The power house has a boiler capacity of 2,800 horse-power. There are four Buckeye engines of 300 horse-power each, five Buckeye engines of 150 horse-power each, two Ball engines of 75 horse-power each, three Buckeye engines of 75 horse-power each, and two Westinghouse compound engines of 250 horse-power each, and there are foundations built for two more of the same type. The company has Brush machines of 1,400 light capacity, all driven from shafting with patent safe feeding oil system. The company also operates 250 arc and 1,000 incandescent lights of the Waterhouse system, 280 arc and about 400 incandescent lights of the United States Electric Lighting Company. The company is, however, controlled by the Westinghouse Electric and Manufacturing Company, which company is now supplying the Baltimore company with a number of additional alternating current apparatus. This includes two 250 Westinghouse alternating current arc machines, and two No. 3 alternating current incandescent machines. When these machines have been installed, the central station will have a capacity of 20,000 incandescent lamps. The company at present furnishes the illumination for the Johns Hopkins Hospital, all the Baltimore theatres, and also the majority of the principal buildings in the city.

New York Office.

The Eddy Electric Manufacturing Company, of Windsor, Conn., has opened a direct branch office at 15 Cortlandt street, New York city, under the management of Mr. Walter C. McIntire. The growth of the business of this company has made this move necessary; and Mr. McIntire is the right man for the place.

The Demand for Wenstrom Motors and Dynamos.

When Chadbourne, Hazelton & Company, took the agency of the United States for the Wenstrom Consolidated Dynamo & Motor Company, last June, it was the intention of the latter company to equip their old factory at Locust Point with new machinery. They determined, however, later to build a new factory, and purchased 100 acres of ground and commenced operations. The new factory has been somewhat delayed owing to the extremely rainy season, and there is such a demand for Wenstrom apparatus that they are entirely unable, with their old facilities, to fill their orders.

At a recent meeting of the directors, the situation was discussed, and in order to hasten matters, the Wenstrom Company have rented a larger factory in Baltimore already equipped with boilers, engines and shafting. The new factory is 60 feet front, 260 feet deep, and is three stories high, and will be in working order by the last of this month. They expect to be able to turn out enough machines here, by working day and night, to fill their most pressing orders, and in the mean time will push to completion their large new factory at Calverton which will be ready for operation by the early Spring to meet the Spring trade and the demand for street railway apparatus, to which this new factory will be almost entirely devoted. This will give the Wenstrom Company as good facilities as any company in the country, and by the first of the year they will be able to fill all orders on time.

Excellent Financial Showing of the Fort Wayne Electric Company.

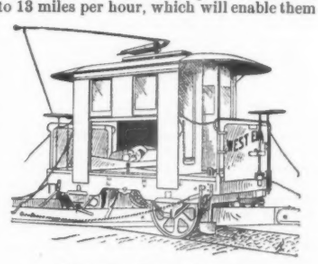
The treasurer of the Fort Wayne Electric Company, says the Boston *News* Bureau, makes report to stockholders of business for the six months ending August 31, 1890: Sales after deducting commissions, $867,545; net profits, $161,207; surplus March 1, $172,334; total, $333,541; dividends May 15, $90,000; present surplus, $243,541. The net profit for past six months has been over four per cent. on present capital of $4,000,000.

By careful estimate of value of assets the face value has been reduced more than $300,000. The increase in number of local companies using the Fort Wayne system during past six months was 24, making total number at present 128. The manufacture of dynamos and lamps will hereafter be conducted at the new factory at Ft. Wayne instead of at Brooklyn, N. Y., thus effecting a large saving in cost.

A New Electric Snow Plough.

The electric snow sweepers used by the West End Railway Company in Boston, last Winter, are to be re-enforced this season by 25 snow ploughs, which have been built under the direction of General Superintendent Monks. The accompanying illustration, for which we are indebted to the Boston *Globe*, gives an idea of the general appearance of this new plough. The car is 14 feet long and six feet wide. Like the ordinary plough, it is equipped with diggers in front of the wheels. These serve to produce a more perfect contact with the rail. It also has double ended shears.

The electrical equipment consists of two 15 horse-power motors placed inside the car. The rheostat is inside the car, and at the end of the route, for instance, will be used to throw off heat, so that the men operating the plough can warm up. The gears on the motors have been dismantled, and on the armature shaft has been placed a sprocket pinion, which gears down, by sprocket chain, to a countershaft in the center of the body, underneath the car frame. This makes one reduction, and there is another from the countershaft to the car axle sprocket wheel. The motors will furnish a speed of from 12 to 13 miles per hour, which will enable them during the Winter months, when it is snowing, to keep out of the way of the regular passenger cars.



ELECTRIC SNOW PLOUGH.

The interior of the plough is lighted by a bunch of three incandescent lamps. On each platform, over the door, there are single lamps, which furnish sufficient light to men operating the plough. The customary headlight is carried on the dasher at night.

KINDRED INTERESTS

The C. McIntire Company, 13 and 15 Franklin street, Newark, N. J., have recently filled some very large orders for their patent connectors and terminals. These useful and unique devices are meeting with great favor.

H. E. & C. Baxter, 18 Fulton street, Brooklyn, manufacturers of electric bells, etc., report that their business is in an especially prosperous condition. They have orders ahead sufficient to tax their manufacturing capacity to its limit for the next few months.

The Crocker-Wheeler Motor Company, of this city, has sent us a large photograph, showing its exhibit at the recent St. Louis Electrical Exposition. The Crocker-Wheeler motors were well arranged, and shown to good advantage in this exhibit. They were included in the artistic exhibit of the St. Louis Electrical Supply Company.

The Jewell Belting Company, of Hartford, Conn., is building a five-story factory, 96x60 feet, to increase its facilities, and a part of the work done in the old building will be removed to the new one, which will probably be completed by the first of December. Besides a general overhauling of the present factory, the company is building a 35x18 addition to its office.

Queen & Company, Philadelphia, are in receipt of numerous flattering testimonials respecting their portable testing sets. We are informed by them that up to date the orders for these sets have come so rapidly that it has been impossible to turn them out fast enough. They have employed additional force, however, and hope soon to be able to carry a supply equal to the demand.

The Johns-Pratt Company, of Hartford, Conn., manufacturers of asbestos and insulating material for electrical purposes, has recently occupied its new buildings; one 138x40 feet, two stories high, and the other, 100x40 feet, three stories high. Both these buildings are handsome brick structures being not only an adornment to the neighborhood, but also a great credit to the enterprising owners.

The Billings & Spencer Machine Company, of Hartford, Conn., will soon erect a brick drop-forge shop at its plant on Laurence street. The main part of the shop will be 237x80 feet, and it will have an extension 40x40 feet, all one story. A temporary structure of corrugated iron and one or two smaller buildings will be torn down to make room for the improvements. The new building will be equipped throughout with electric lights.

The Tropical American Telephone Company, in addition to the regular American Bell Company telephone set, are now offering a special export set complete at $15.00, and a new platinum pointed magneto set at $17.00. It is also receiving old magneto bells in exchange for new ones of later and more improved style, and will also take old style switchboards in exchange for new ones. Its business is growing rapidly and its field and specialties are broadening and increasing.

W. R. Fleming & Company, 174 Fulton street, New York, selling agents for the Foundry and Machine Department, Harrisburg, Pa., have just taken orders for the equipment of several large steamers belonging to the Transatlantica Espanola Line with their self-oiling "Ideal" engines for electrical purposes. This steamship company ranks among the three largest in existence, and is the one to which belonged the "Viscaya," which was recently wrecked by collision, attended with such disastrous loss of life. The "Viscaya" was to have been equipped at once by W. R. Fleming & Company. They also report the receipt of many large orders for engines and their superior steel return tubular boilers, from electric light and street railway companies. Their works are running day and night.

Stanley & Hall, 32 and 34 Frankfort street, New York, have recently secured the ground floors of their building and are fitting up a cosy suite of offices. The space in the upper floors, formerly used for offices, will now be utilized for manufacturing purposes. This is the latest of a series of enlargements recently made by this enterprising firm on account of the rapid growth of business. Stanley & Hall will undoubtedly be glad to welcome their many friends in their new offices, which are in a very convenient locality.

Charles A. Schieren & Company, 45 to 51 Ferry street, New York, on August 20, 1890, furnished the Metropolitan Street Railway Company, of Toronto, with the following belting: 48 feet 12 inches double electric perforated belt, and 85 feet 28 inches double electric perforated belt. In answer to their inquiry, the following testimonial was received:

Toronto, Nov. 8, 1890.

Chas. A. Schieren & Co., N. Y. City, Gentlemen: In regard to the belts, as far as we are able to judge, they are giving every satisfaction. We have certainly realized that the power required for electric railway purposes is very exceptional, and the demand is very irregular. We are glad, however, to state that the belts seem to meet all requirements. We have not had, so far, the slightest trouble with slippage, and cannot but express ourselves as greatly pleased. If they will stand the test of time we do not see that we can desire any improvement. If any parties in this market require anything of the kind we shall be very pleased to have you refer them to us, and we will show them our belts in operation.

Yours truly,
METROPOLITAN ST. RY. CO., of Toronto,
CHAS. D. WARREN, Prest.

FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire & Co., Electrical Securities, 18 Wall street, N. Y., Saturday, November 15, 1890. New York, Boston and Washington Stock Exchanges. Pittsburgh closing November 14, 1890.

NEW YORK.	
Western Union Telegraph Co.	76.
American Telegraph & Cable	83.
Central and South American	155.
Mexican	210.
Commercial Cable Co.	101½.
Postal Telegraph Cable	39.
Edison General Electric Co.	82½.
" " Deferred	70.
Consolidated Electric Light	
Edison Electric Illuminating Co.	60.
United States Electric Light	
North American Phonograph	30.
BOSTON.	
Thomson-Houston Electric Co.	39⅞.
" " " Preferred	26¼.
" " " Series C	11½.
" " " Series D	6.
" " International Co.	
" Welding Co.	180.
" European Welding Co.	
Ft. Wayne Electric Co	*11.
TELEPHONE:	
American Bell	210.
Erie	*47.
New England	51.
Mexican	.75
Tropical American	
MISCELLANEOUS:	
Edison Phonograph Doll	2.
WASHINGTON.	
Pennsylvania Telephone	25.
Chesapeake and Potomac	66.
American Graphophone	11½.
United States Electric Light (Washington)	140.
Eckington and Soldiers' Home Electric Ry.	56.
Georgetown and Tennallytown	50.
PITTSBURGH.	
Westinghouse Electric Mfg. Co.	27⅞.

*Ex. Dividend.

YOU make a mistake if you don't buy your Electrical Supplies from F. & F., Cleveland, O.

LOOK AT THESE PRICES:

$2 Electric Bells, 50c., 75c. Bronze.
Push Buttons, 25c.; 25c. Wood Push.
Buttons, 7c.; 50c. Switches, 15c.
40c. Bell Hangers' Staples, per lb., 10c.
$1 Lecianche Batteries, 45c.
$1 Carbon Batteries, 40c.
$3.75 Spark Coils, $1.50; $10 Medical Batteries, $3.50.
Dry Batteries, Motors, Dynamos and Annunciators at half price. Send for reduced price list and discounts.

Fletcher & Fletcher Electric Co., Cleveland, O.

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NEWARK, N. J.

ARC DYNAMO WANTED. One Second Hand No. 8 Brush Arc Dynamo.
Address,
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BUFFALO, N. Y.

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PATENT PERFORATED ELECTRIC LEATHER BELTING
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COR. CLIFF ST.
BRANCHES:
BOSTON, 119 HIGH STREET.
PHILADELPHIA, 226 NORTH 3d STREET.
CHICAGO, 46 SOUTH CANAL STREET.

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85 & 87 JOHN ST., NEW YORK.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON NOVEMBER 11, 1890.

440,155 Phonograph; Isaac W. Heysinger, Philadelphia, Pa.

440,164 Telegraph circuit. 440,165 Multiplex telegraphy; David H. Keeley, Ottawa, Can.

440,175 Secondary battery; Frederich Marx, Berlin, Germany.

440,189 Electric motor truck and gear; Edgar Peckham, New York, N. Y.

440,199 Induced current telegraph; Abner M. Roseburgh, Toronto, Can.

440,210 Electrode for secondary batteries; Ewd. B. Weed, Detroit, Mich., assignor to John E. Wiles, same place.

440,213 Electric switch; Malone Wheless, Nashville, Tenn., assignor, by direct and mesne assignments, to the Wheless Electric Railway Co., Alexdria, Va.

440,216 Secondary battery plate; Albert E. Wolf, New York, N. Y.

440,224 Distribution of electric energy; Sebastian Z. DeFerranti, Hempstead, England.

440,241 Electric actuating mechanism for clocks; Herman T. Schlegal, Akron, O., assignor, by direct and mesne assignments, of three-fourths to Albert A. Schlegel and Michael J. Gilbo, both of same place.

440,267, 440,274, 440,275, 440,276 Process of producing porous crystallized metal plates. 440,268, 440,277 Process of producing crystallized metallic lead plates. 440,269 Process of producing crystallized lead plates. 440,270 Art of producing crystallized metal plates. 440,271 Porous crystallized metal plate. 440,272 Method of making porous crystallized metal plates. 440,273 Process of making porous crystallized metal plates; Clement Payen, Philadelphia, Pa., assignor to the Electric Storage Battery Co., Gloucester City, N. J.

440,289 Dead-beat mechanism for electrical measuring instruments. 440,290 Temperature regulator for electrical measuring instruments. 440,291 Index controling device for electrical measuring instruments; Edward Weston, Newark, N. J.

440,303 Electric switch; Arthur R. Bush, Boston, Mass., assignor to Paine and Francis, same place.

440,326 System of electrical distribution; Walter S. Richards, Natick, assignor of one-half to Geo. B. James, Boston, Mass.

440,361 Combined lightning arrester and cut-out; John A. McManman, Milwaukee, Wis.

440,362 Electric railway; James K. P. Nourse, Boston, Mass., assignor to himself, Luther Daniels, same place, and John A. Fogg, South Weymouth, Mass.

440,384 Adjustable resistance for electric circuit; Chas. Wirt, Orange, N. J.

440,391 Insulating composition; Frederick E. Blaisdell, Camden, N. J., assignor to the Sil-Crusta Mfg. Co., same place.

440,395 Method of manufacturing insulating tubing for electric conducting wires; Henry B. Cobb, Wilmington, Del.

440,430 Galvanic battery; Wm. Cohlman, Philadelphia, Pa.

440,424 440,557 Dynamo electric machine. 440,425 Current collector for dynamo electric machines; Walter K. Freeman, Brooklyn, N. Y., assignor to William S. Hadaway, Jr., trustee, Boston, Mass.

440,431 Electric meter; Etienne Mares, Paris, France.

440,441 Electric clock; Frank Schwartz, Halifax, Can.

440,502, 440,503 Electric railway switch and signal mechanism; Joseph Ramsey, Jr., and Fredric C. Weir, Cincinnati, O.

440,505 Electrolyte for secondary batteries; Bernard Renault and Maurice Desvernay, Paris, France.

440,508 Electric train signal; Fitzwilliam Sargent, Aurora, Ill.

440,524 Phonograph; John H. White, Washington, D. C.

440,534 Method of and apparatus for making metallic wheels by electricity; William P. Bettendorf and Joseph W. Bettendorf, Davenport, Ia.

440,563 Combined system of fire alarm and police patrol telephone and telegraph; Geo. C. Hale and Albert Barrett, Kansas City, Mo.

440,567 Thermometer; Madison G. Hawke, Saratoga Springs, N. Y.

440,584 Shipper for trolleys; Herbert H. Brooks, Cambridge, assignor of one-half to Arthur F. Bardwell, Boston, Mass.

440,590 Electrical governor; Franklin D. Hardy, Chicago, Ill., assignor of part to Crews & Owen and Edwin J. Blood, all of same place.

440,595 Electric railway; Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Co., Boston Mass.

440,596 Electric railway. 440,597 Contact device for electric cars; Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Co. of of America, same place.

440,604 Arc lamp; Samuel E. Nutting, Chicago, Ill., assignor to the Nutting Electric Mfg. Co., same place.

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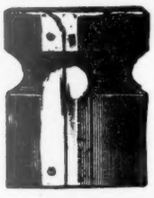

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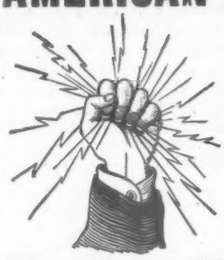

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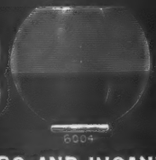
GLOBES  **SHADES**

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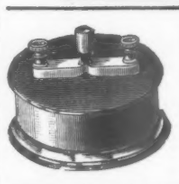

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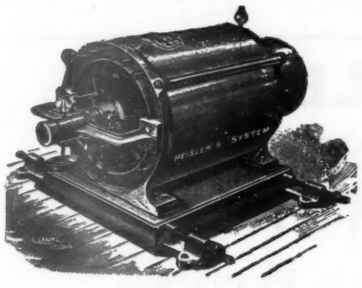
Awarded the Highest Distinction, a Gold Medal, at the Paris Exposition, 1889.

UNEQUALLED FOR DISTRIBUTION OVER WIDE AREAS.



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Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,800 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in Inches.	Belt Speed Required. 5,000 FEET PER MINUTE.	Weight of Dynamo.
C	8	.....	.....	.....	6.5	1¼		530
C	.....	10	.....	.....	6.3	1¼		530
C	.....	.....	.....	25	8.0	2		530
E	16	.....	.....	.....	12.0	2½		780
E	.....	20	.....	.....	12.5	2½		780
E	.....	.....	26	.....	13.0	2¾		780
E	20	.....	.....	.....	15.0	3		990
E	.....	25	.....	.....	15.6	3		990
E	.....	.....	32	.....	15.0	3		990
C	.....	.....	.....	50	16.0	3		990
C	28	.....	.....	.....	21.0	4½		1,360

Ball Electric Light Co., 404 WEST 27th STREET, NEW YORK

LIST OF DYNAMOS IN STOCK.

Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,800 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in Inches.	Belt Speed Required. 5,000 FEET PER MINUTE.	Weight of Dynamo.
G	.....	35	.....	.....	21.0	4		1,360
G	.....	.....	45	.....	21.0	4		1,360
G	.....	.....	.....	70	21.0	4½		1,360
H	40	.....	.....	.....	29.7	6		1,750
H	.....	50	.....	.....	30.0	6		1,750
H	.....	.....	64	.....	29.5	6		1,750
I	52	.....	.....	.....	38.0	8		2,290
I	.....	65	.....	.....	38.6	8		2,250
I	.....	.....	83	.....	38.0	8		2,290
J	64	.....	.....	.....	46.5	10		2,770
J	.....	80	.....	.....	47.1	10		2,770
K	75	.....	.....	.....	52.5	12		3,200

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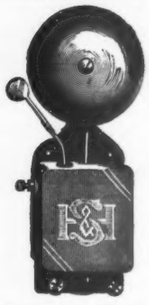

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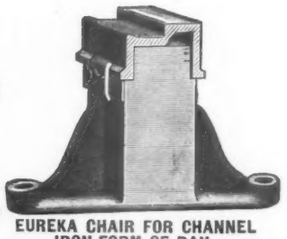

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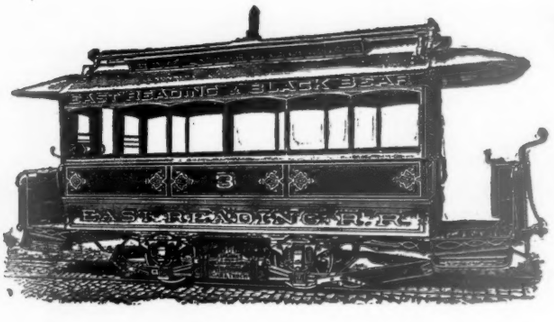

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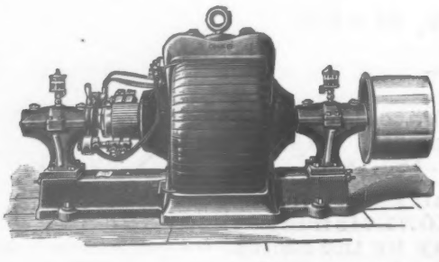

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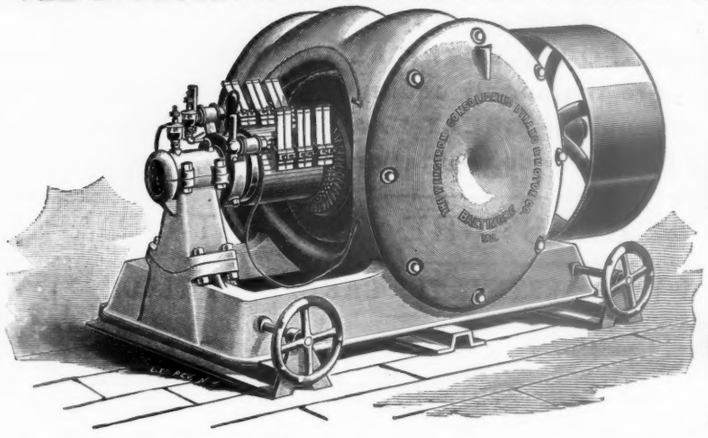

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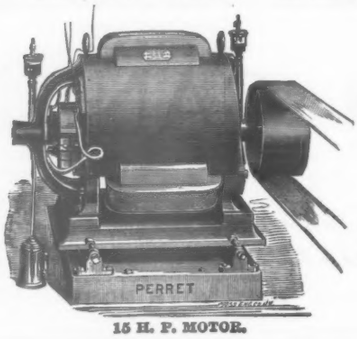

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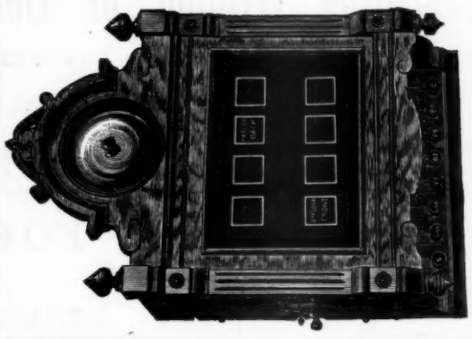

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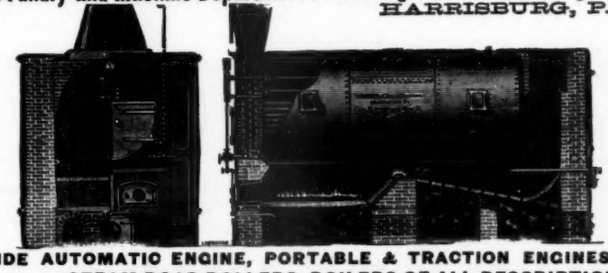

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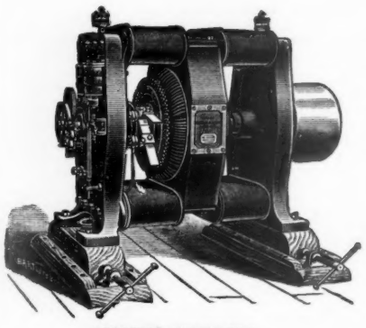

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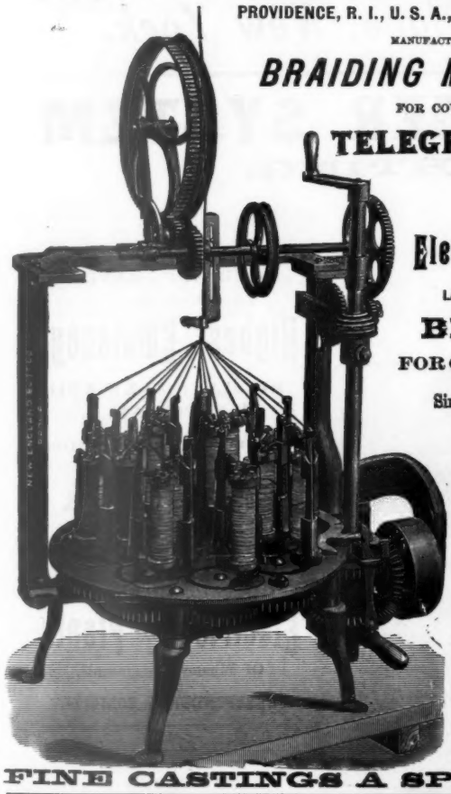

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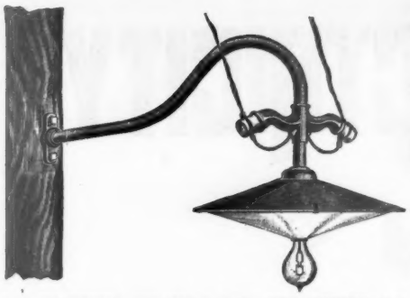

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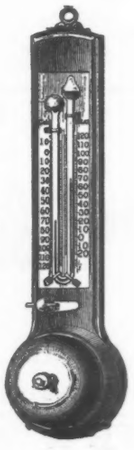

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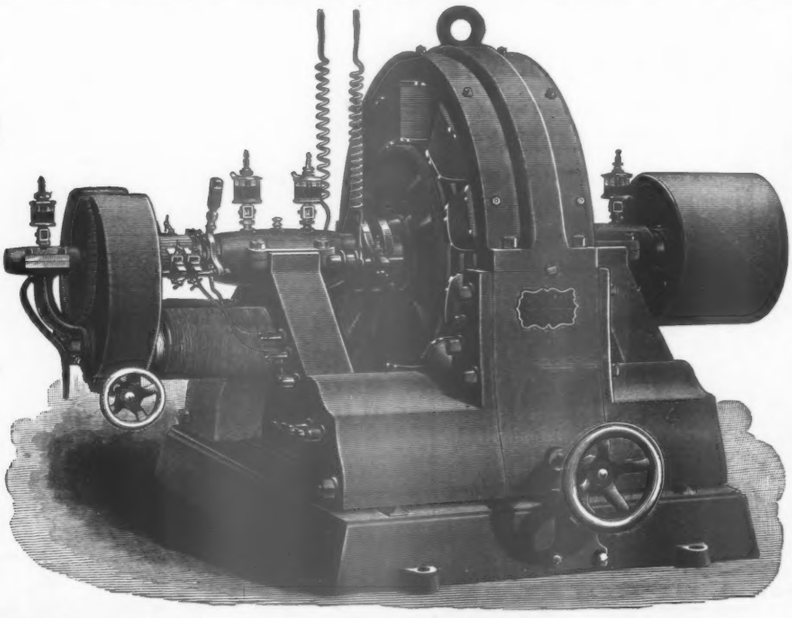

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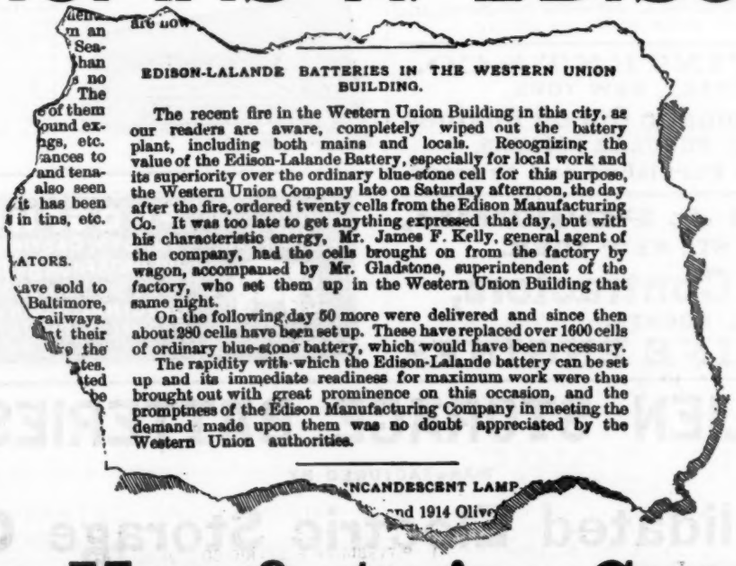

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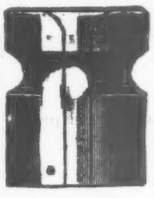

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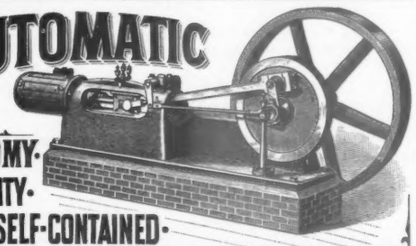

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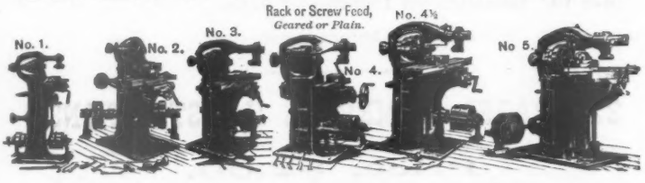

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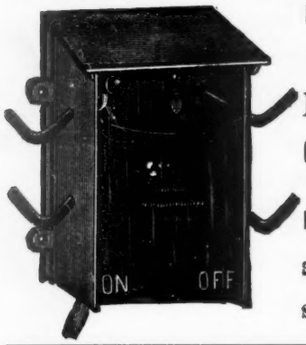

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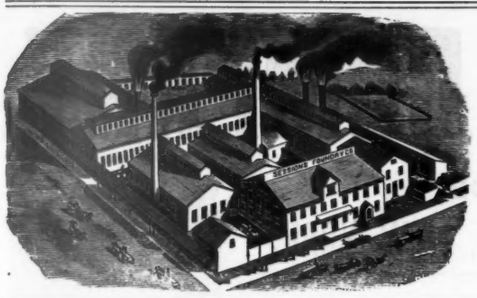

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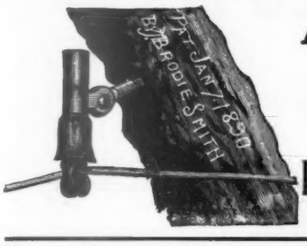

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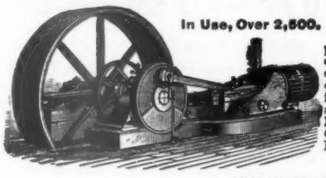

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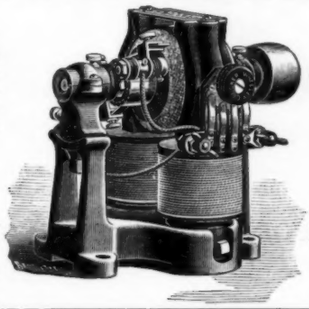

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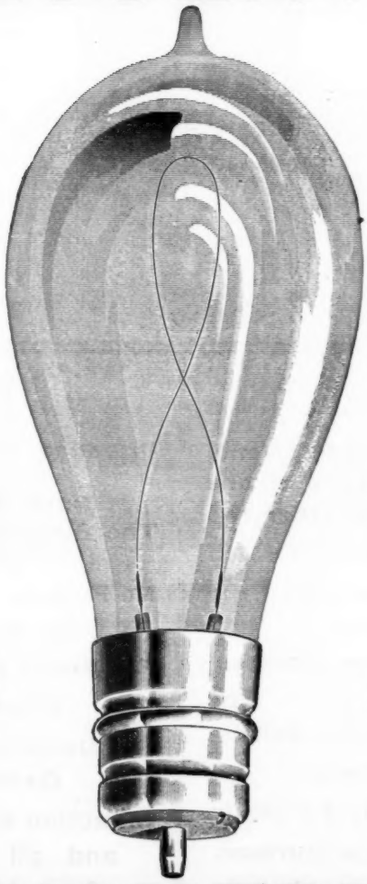

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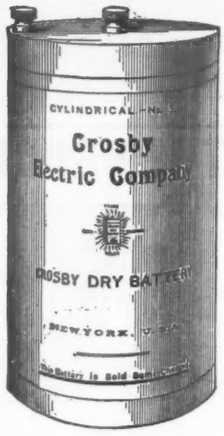

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